AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.2.2 ANIMAL TISSUES, ORGANS AND ORGAN SYSTEMS (PACK 1)

SCORE	PERCENTAGE
/351	%

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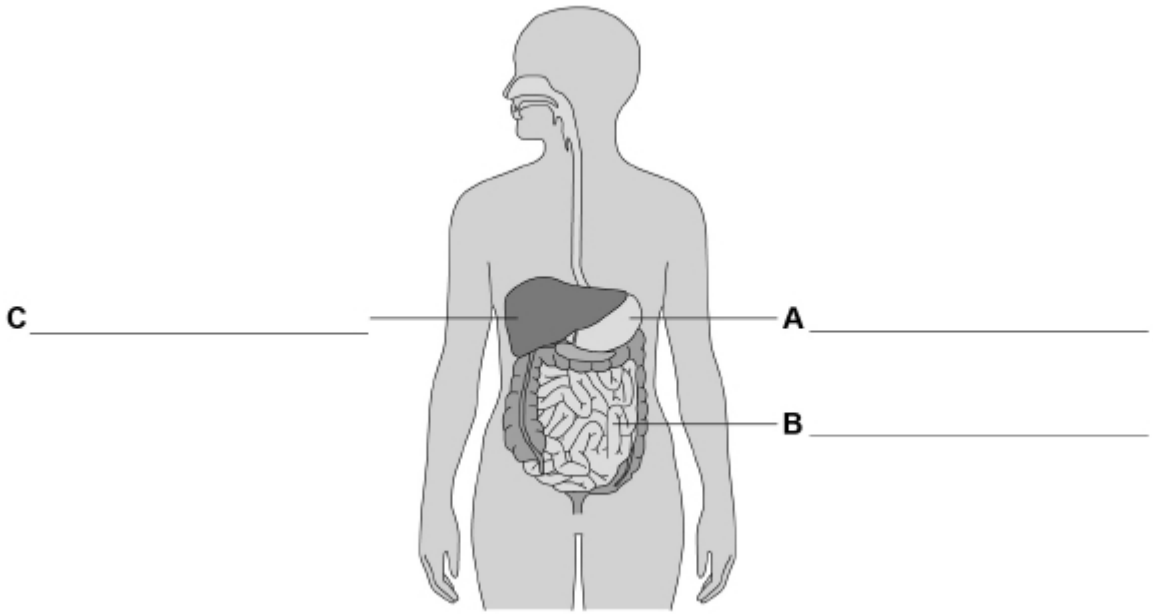
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Q1.

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.

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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.

_____

_____

_____

_____

_____

_____

_____

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_____

_____

_____

(4)

(g) Complete the sentence.

Choose the answer from the box.

fat	**fibre**	**minerals**	**vitamins**

Obesity can be caused by a diet high in _____ .

(1)

(h) Complete the sentence.

Choose the answer from the box.

skin cancer	**type 1 diabetes**	**type 2 diabetes**

Obesity is a risk factor for _____ .

(1)

(Total 15 marks)

Q2.

This question is about the circulatory system.

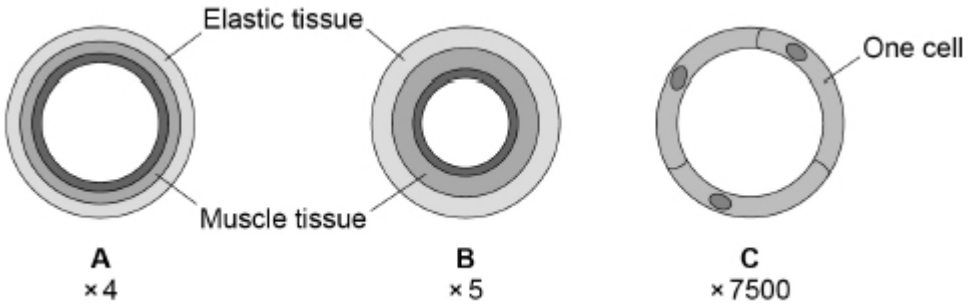
(a) Draw **one** line from each blood component to its function.

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

(3)

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(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 cm^3 / 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 = _____ cm^3 / minute

(1)

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

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_____

_____

(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 recommended	When only one blockage is present	When multiple blockages are present
Time spent in hospital after procedure	2-3 hours	at least 7 days
Recovery time after procedure	7 days	12 weeks

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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.

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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.

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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?

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Volume of milk = _____ cm^3

(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.

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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 cm^3 of milk
   - 7 cm^3 of sodium carbonate solution (to make the solution above pH 10)
   - 5 drops of the indicator
   - 1 cm^3 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**.

_____

_____

_____

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_____

_____

_____

(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	☐
Pancreas	☐
Pituitary gland	☐
Thyroid	☐

(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?

_____

_____

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(1)

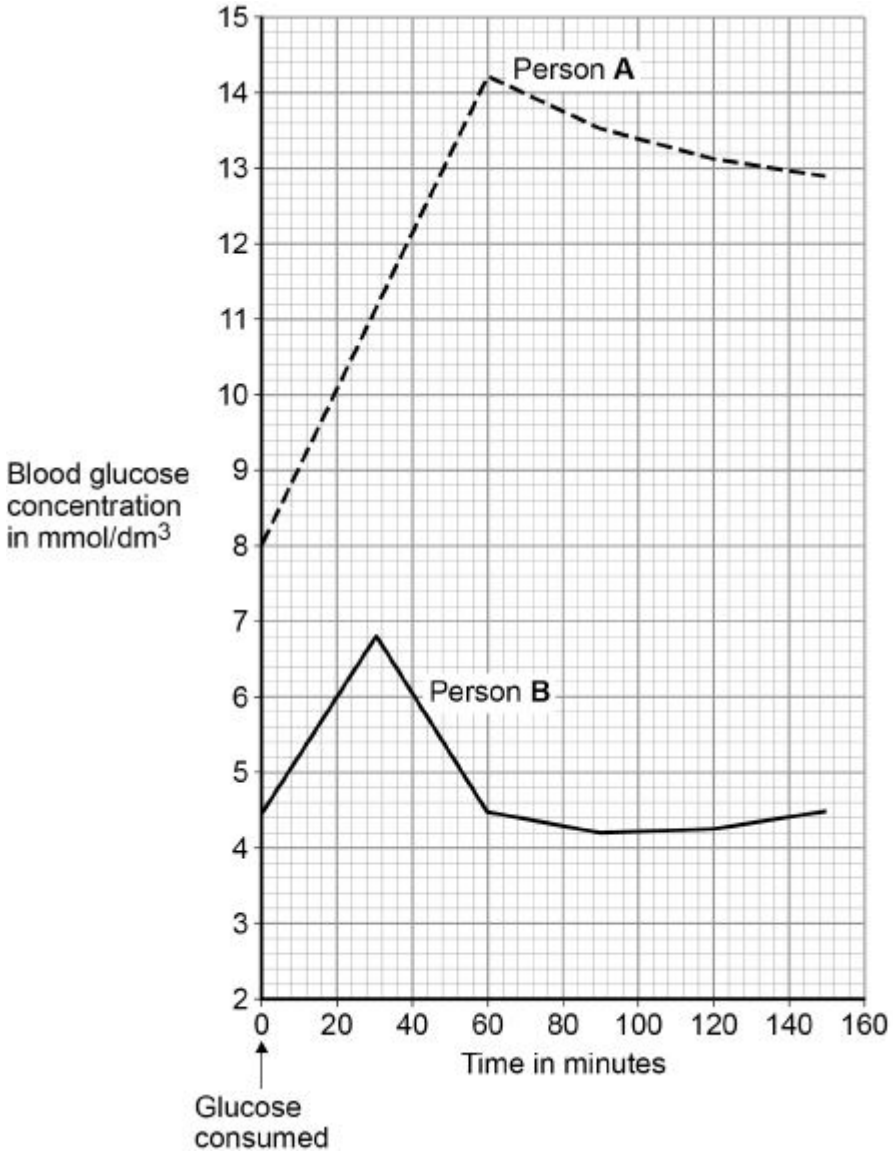
Two people each drank the same volume of a glucose drink.

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**.

_____

_____

_____

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Answer = _____ $mmol/dm^3$

(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**.

_____

_____

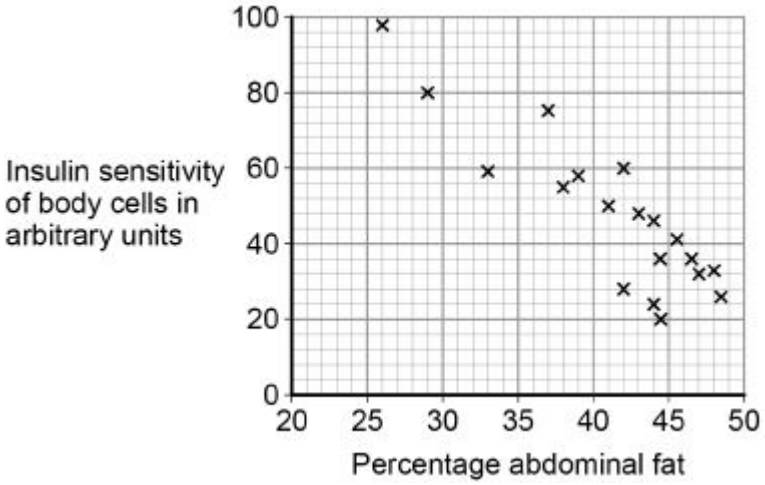
(1)

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.

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

1. _____

_____

2. _____

_____

(2)

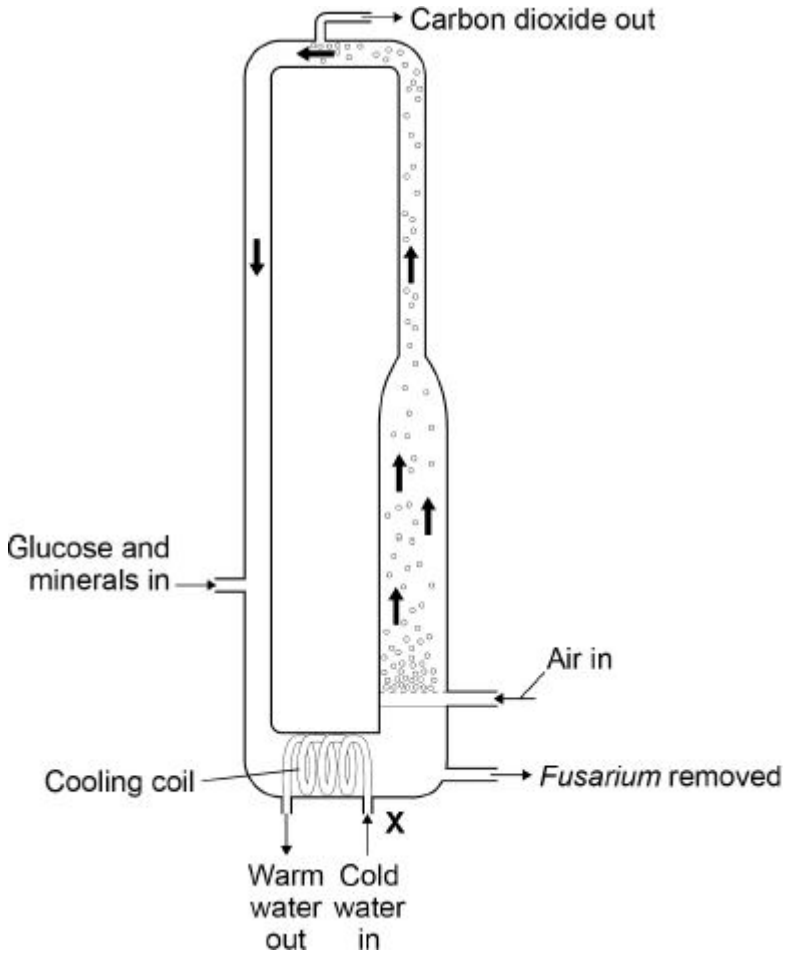
(Total 10 marks)

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.

_____

_____

_____

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_____

(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.

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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



Algae → Invertebrate animals → Small fish → Large fish

	Algae	Invertebrate animals	Small fish	Large fish
Biomass in g/m^2:	840	200	40	10

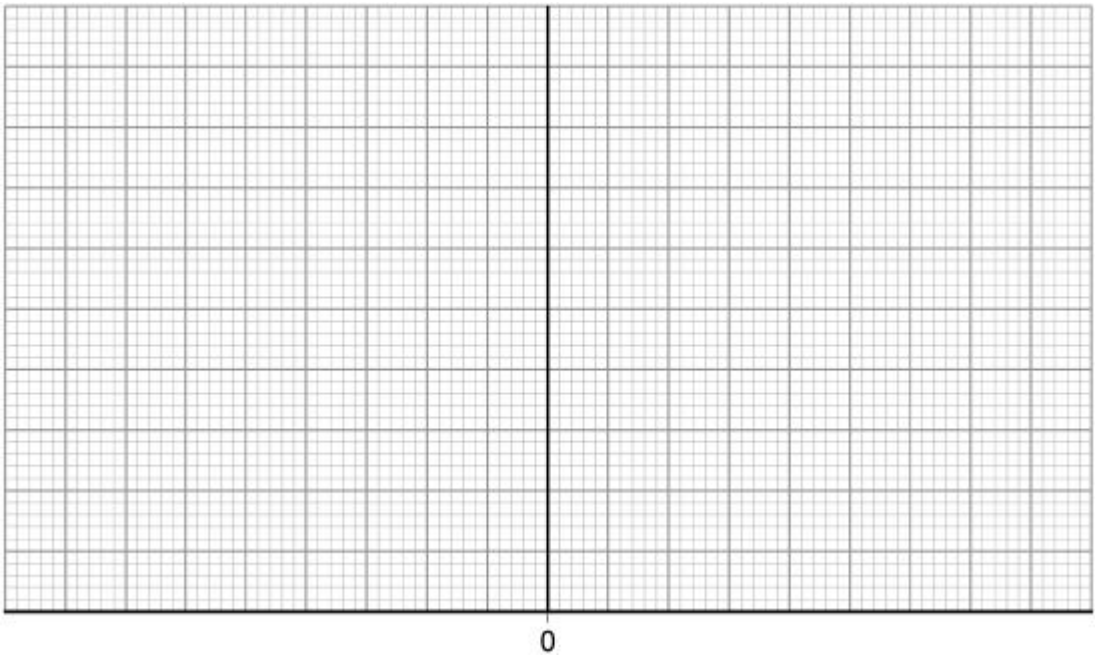
(a) Draw a pyramid of biomass for the food chain in **Figure 1** on **Figure 2**.

You should:

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

Figure 2

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(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.

_____

_____

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(5)
(Total 13 marks)

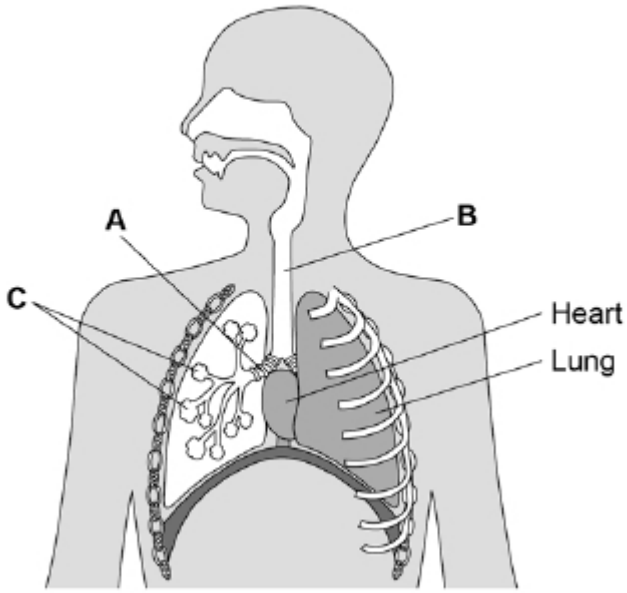
Q8.

Animals and plants contain organs and tissues.

Figure 1 shows some organs in the human thorax.

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Figure 1



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

A _____

B _____

C _____

(3)

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

Tick **one** box.

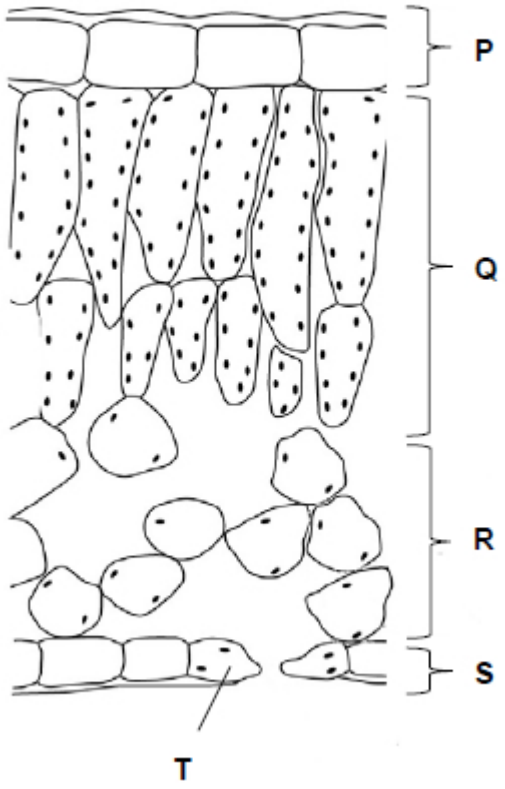
- Breathing system ☐
- Circulatory system ☐
- Digestive system ☐
- Excretory system ☐

(1)

Figure 2 shows a cross section of a leaf.

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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.

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What is a tissue?

_____

_____

(1)

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

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

(3)

(Total 10 marks)

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 _____

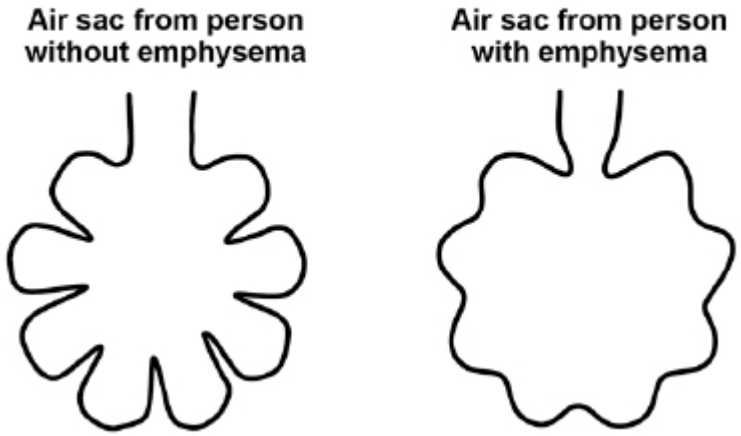
(1)

(c) Smoking can cause emphysema.

Look at **Figure 1** below.

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Figure 1



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**

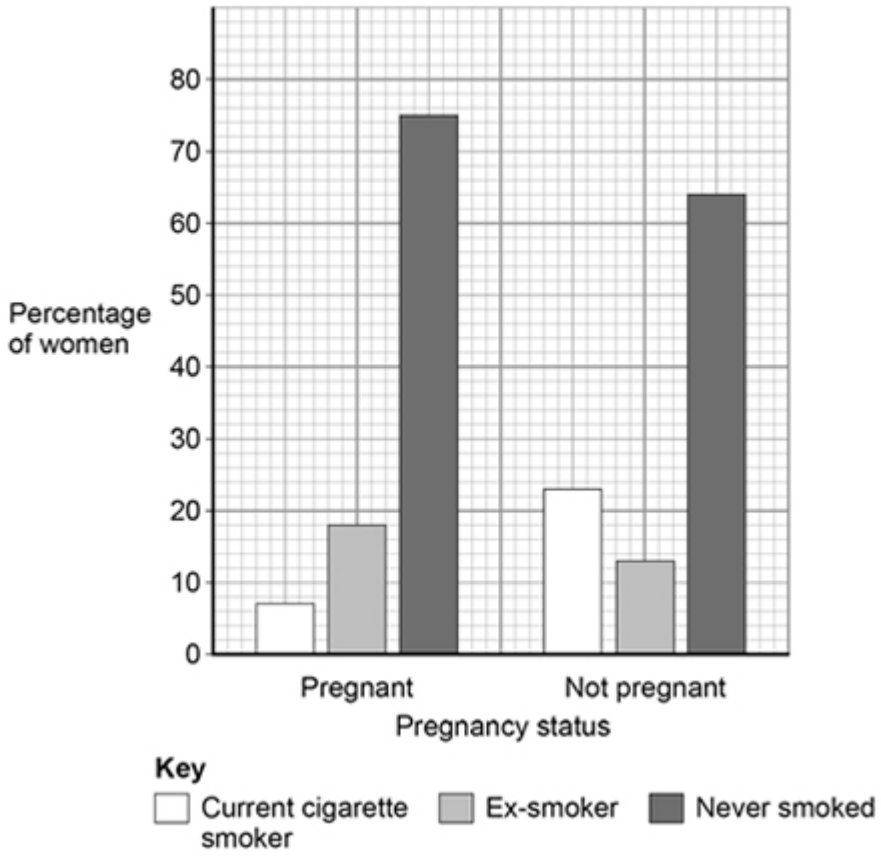
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A	2678	Normal birth mass
B	1345	
C	991	

(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. _____

_____

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2. _____

_____

3. _____

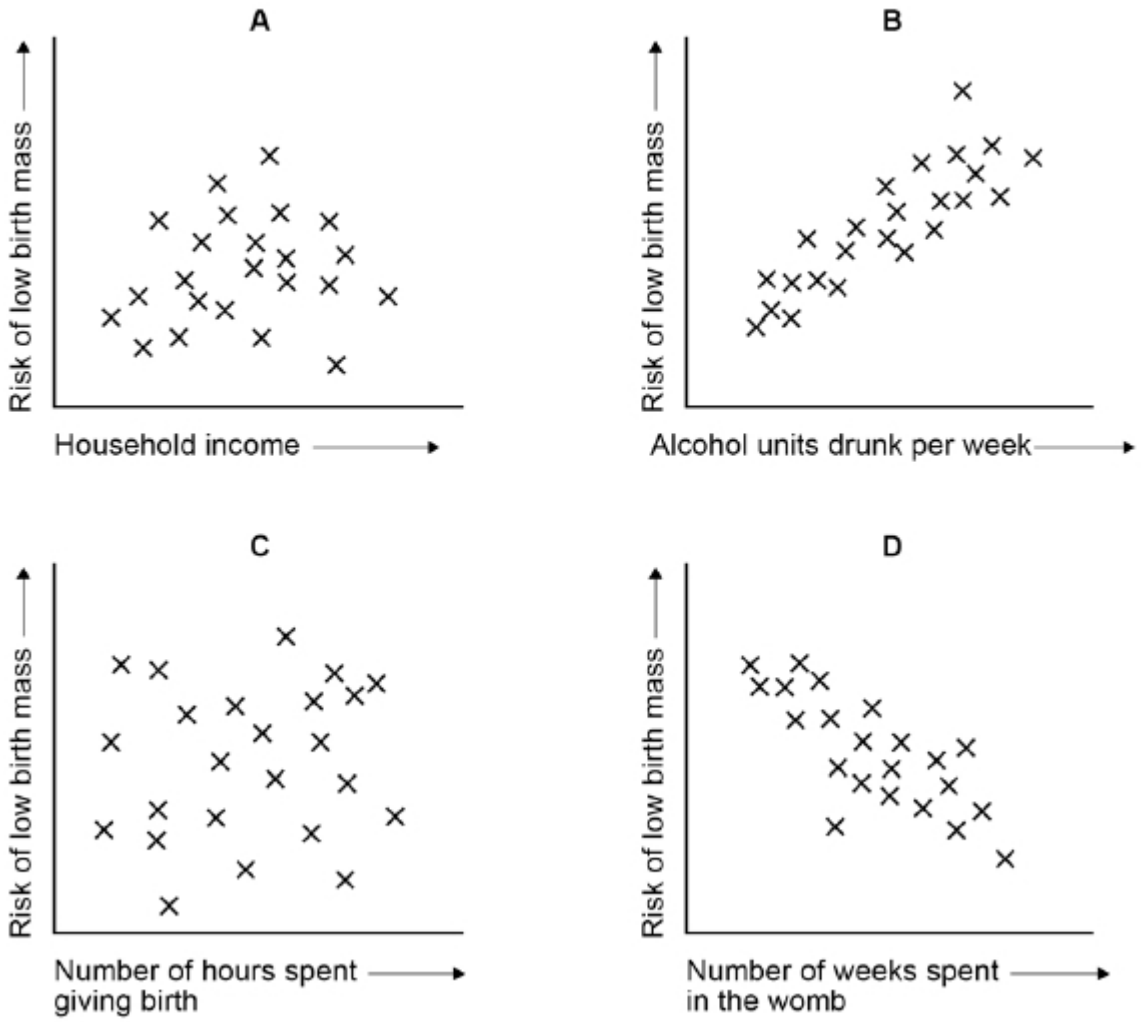
_____

(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 ☐

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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?

_____

_____

_____

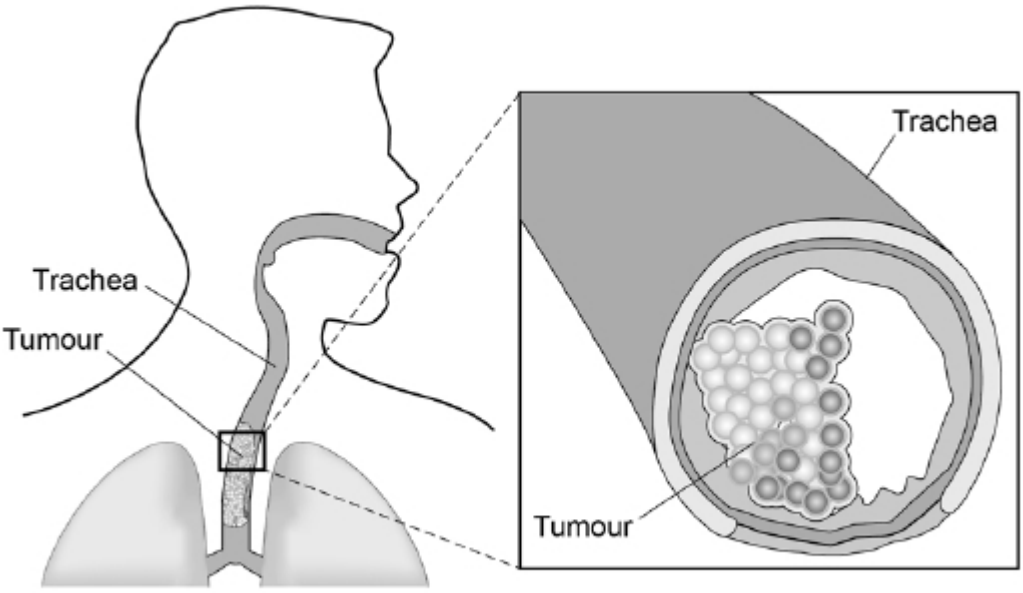
_____

(2)

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

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Figure 1



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

_____

_____

(1)

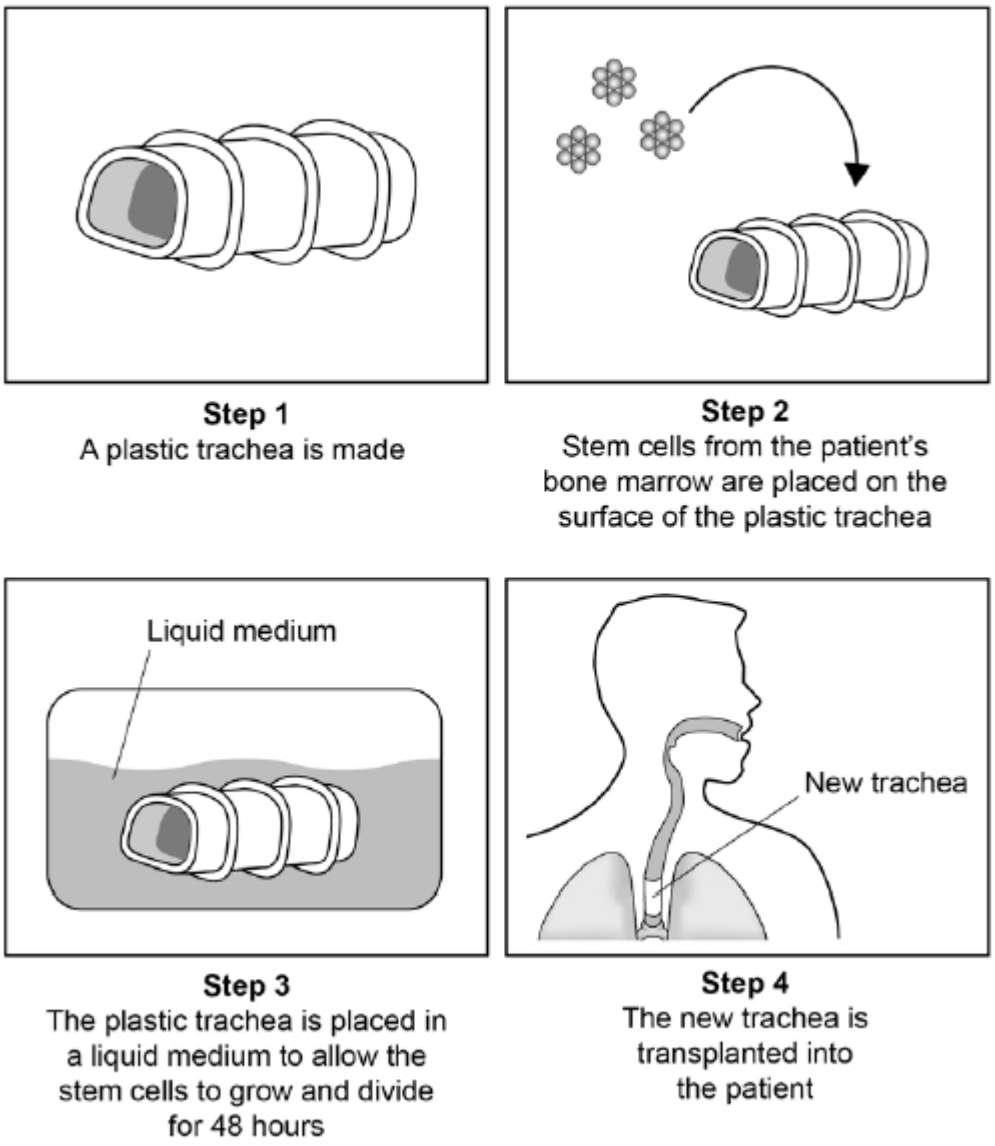
Scientists can treat the patient's tumour by replacing the trachea with a plastic trachea.

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

Figure 2 shows the procedure.

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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.

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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.

Give a conclusion to your answer.

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 16 marks)

Q11.

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

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

_____

(1)

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

In a person at rest:

- blood travels at a mean speed of 10 cm/s in the aorta
- blood travels at a mean speed of 0.5 mm/s in the capillaries
- the speed of blood decreases at a rate of 0.4 cm/s^2 as blood travels from the aorta to the capillaries.

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

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

Use the equation:

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

Give your answer to 2 significant figures.

Time = _____ s

(4)

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

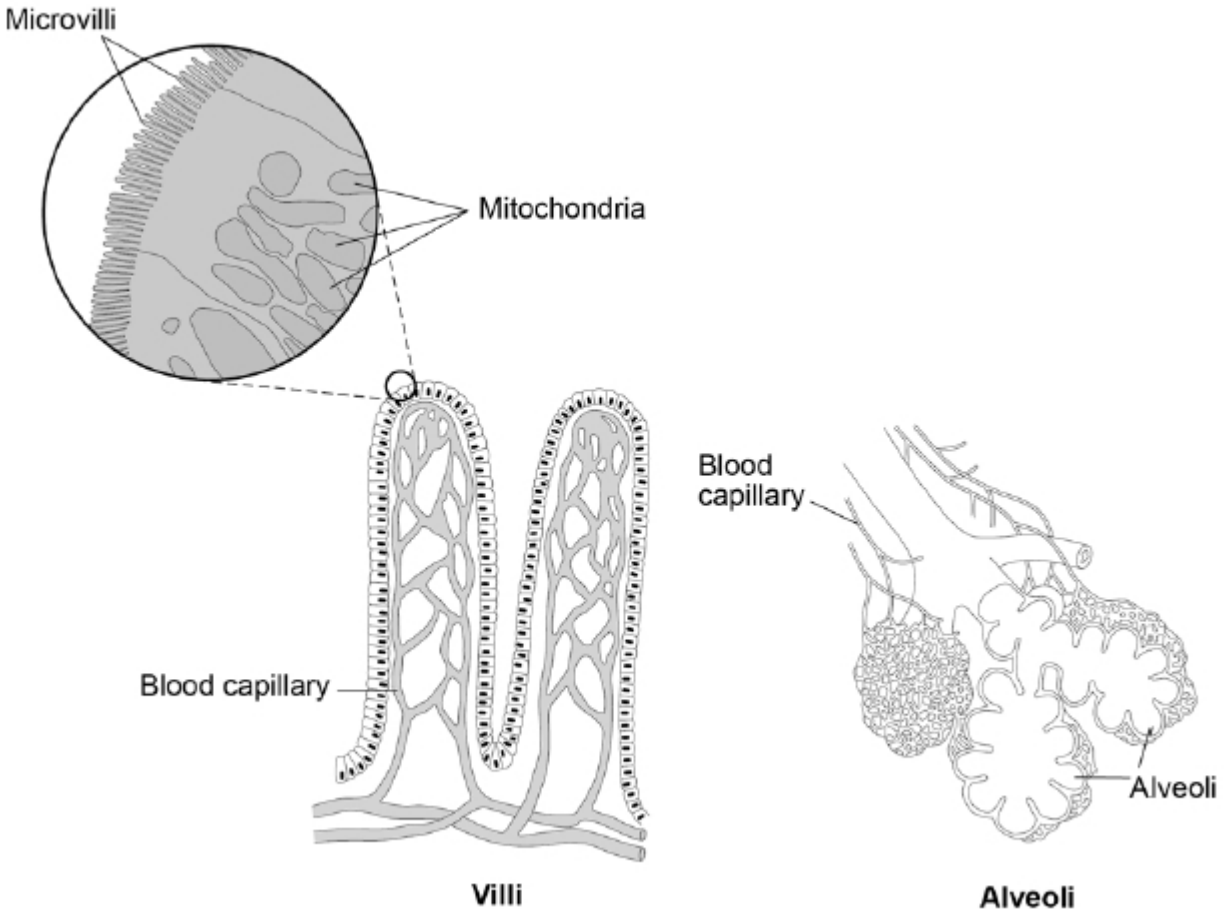
(4)

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

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- 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 ☐

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Liver and stomach ☐

Salivary glands and pancreas ☐

Salivary glands and stomach ☐

(1)

(b) Enzymes speed up chemical reactions.

Explain how amylase breaks down starch.

_____

_____

_____

_____

_____

_____

(3)

(c) One sugar in the body is glucose.

Glucose is used for respiration.

Give **one** other use for glucose in the body.

_____

(1)

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

This is the method used.

1. Put 2 cm^3 of 1% starch solution into a boiling tube.
2. Put 2 cm^3 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**?

_____

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_____

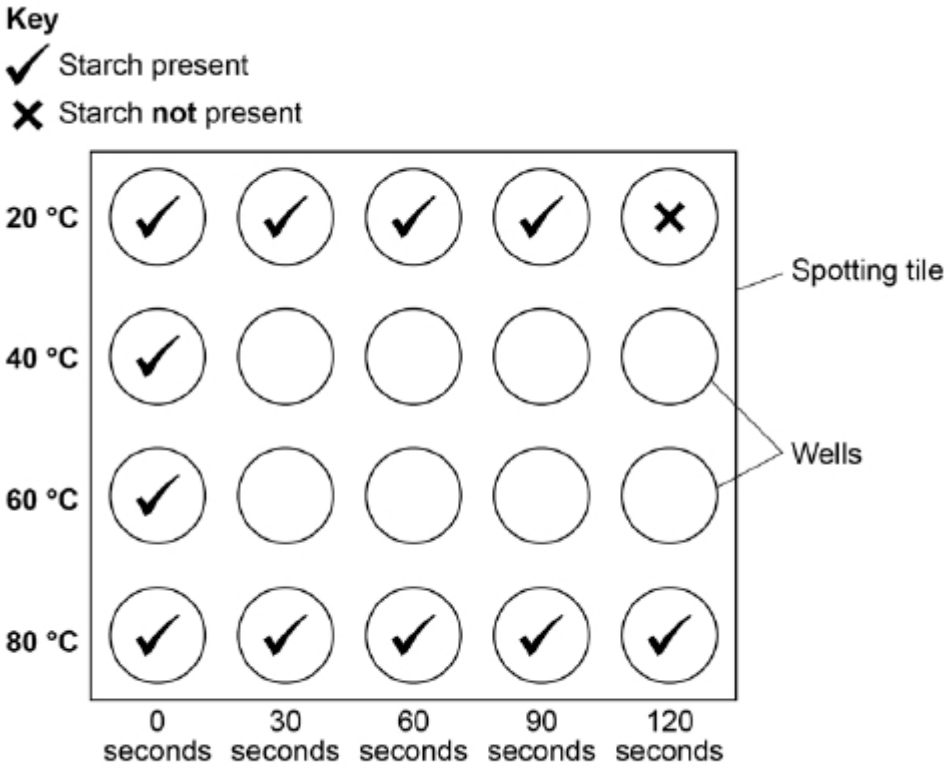
(1)

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

The diagram below shows the results of the investigation at 20 °C and at 80 °C

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

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



(2)

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

One other method is to measure the **concentration** of starch present in the solution every 30 seconds.

Why is this method better than the method the student used?

_____

_____

_____

_____

(2)

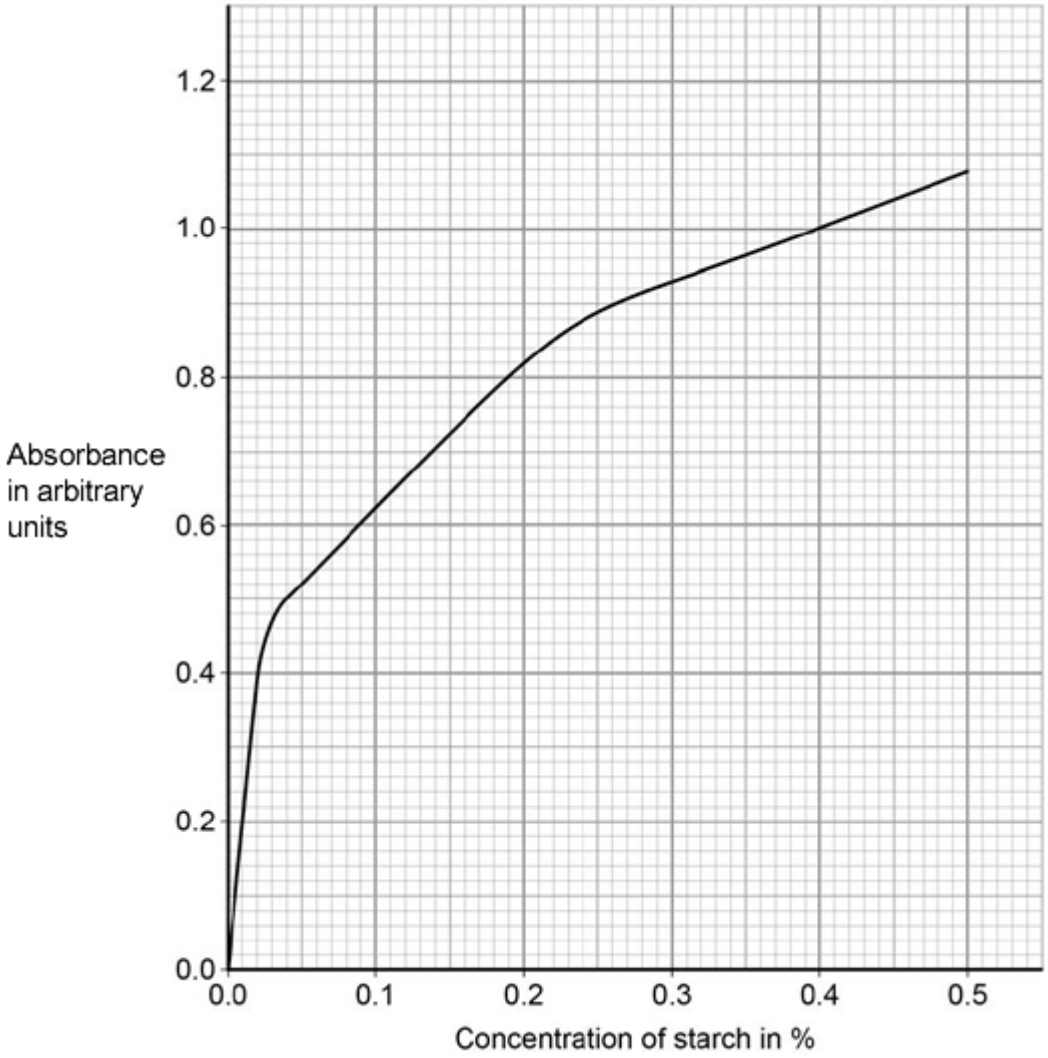
A colorimeter can be used to measure the concentration of starch present in the solution every 30 seconds.

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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.

_____

_____

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_____

_____

(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 cm^3 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.

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Figure 1

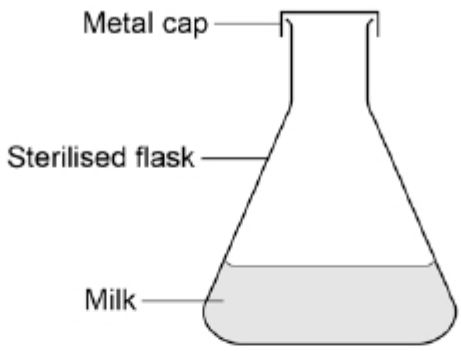
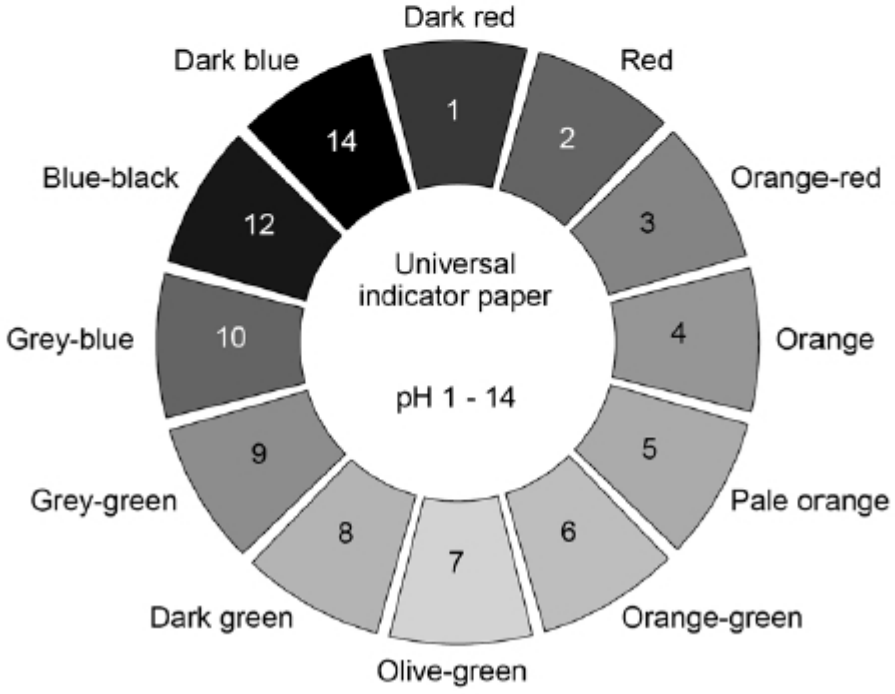


Figure 2



(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)

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(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

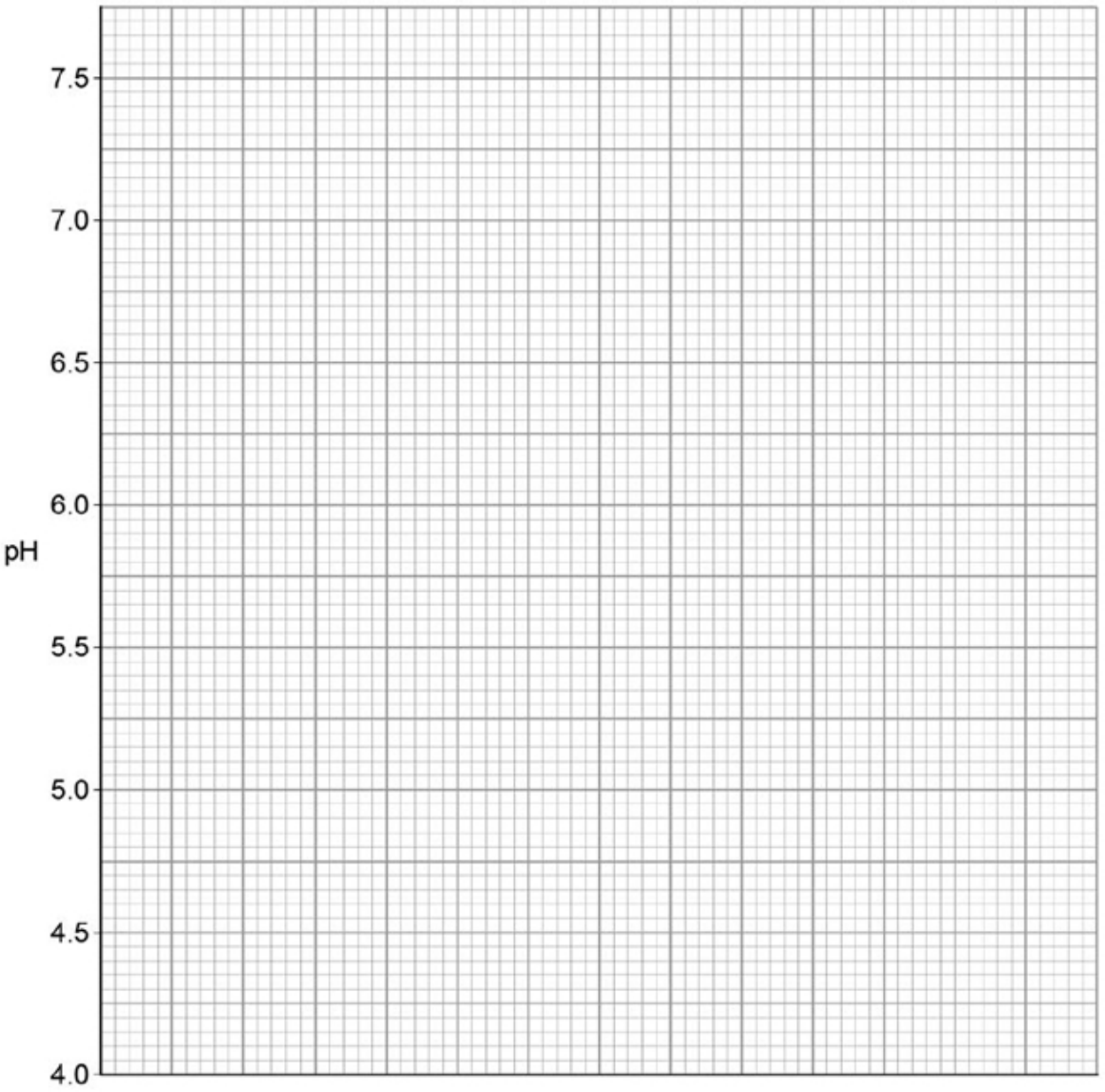
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4	5.0
5	4.5
6	4.5

(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.

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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)

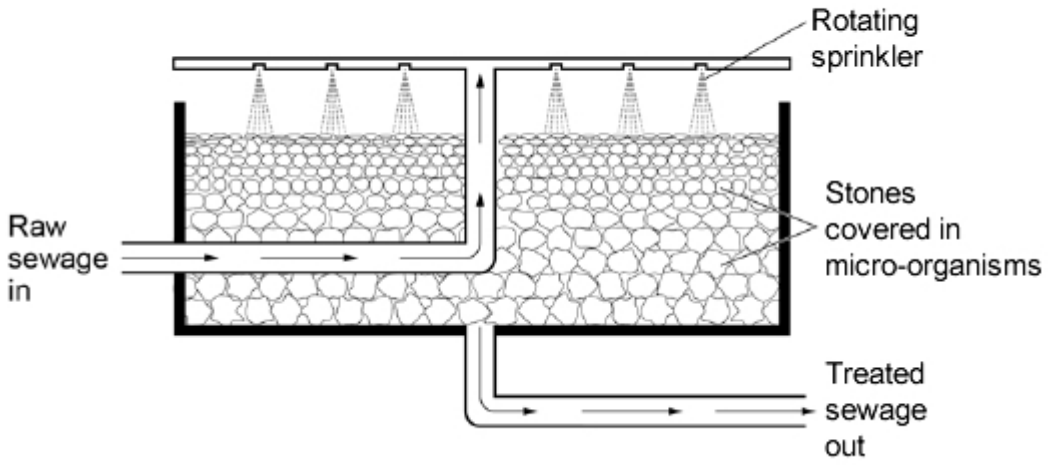
Q14.

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



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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. _____

_____

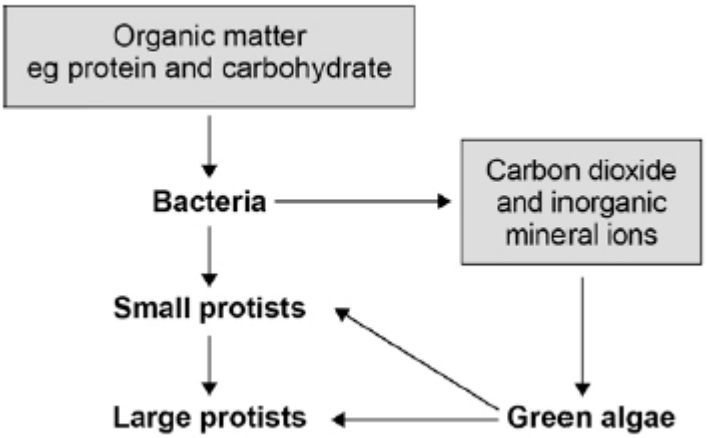
2. _____

_____

(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)

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(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.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 8 marks)

Q15.

In humans, chromosome **X** and chromosome **Y** are the sex chromosomes.

(a) Most cells in the human body contain two sex chromosomes.

Which type of cell does **not** have two sex chromosomes?

Tick **one** box.

Liver cell ☐

Muscle cell ☐

Nerve cell ☐

Red blood cell ☐

(1)

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

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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 ☐

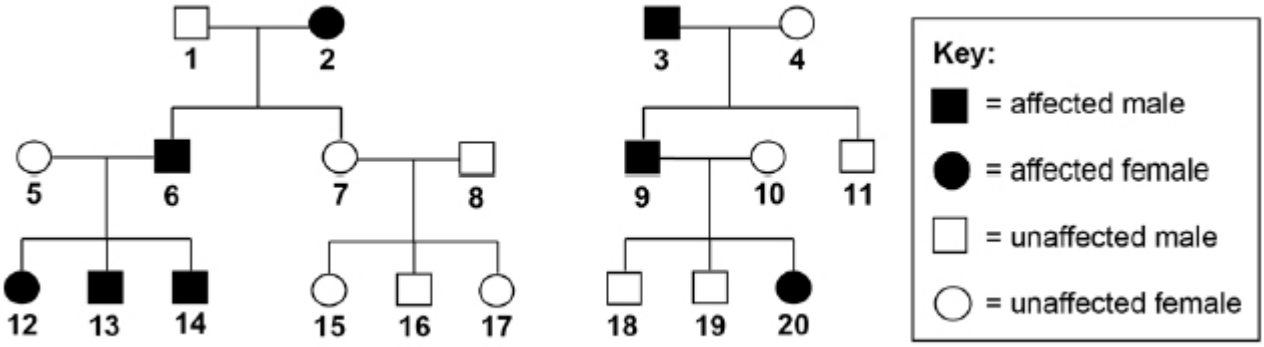
Retina ☐

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.

_____

_____

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_____

_____

(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 = _____

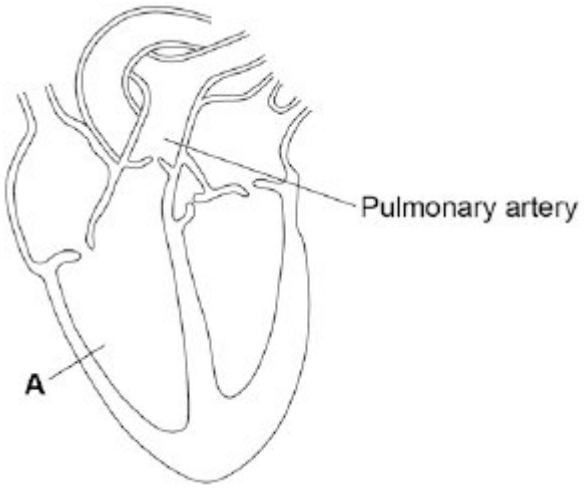
(4)

(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)

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

Tick **one** box.

Brain ☐

Liver ☐

Lungs ☐

Stomach ☐

(1)

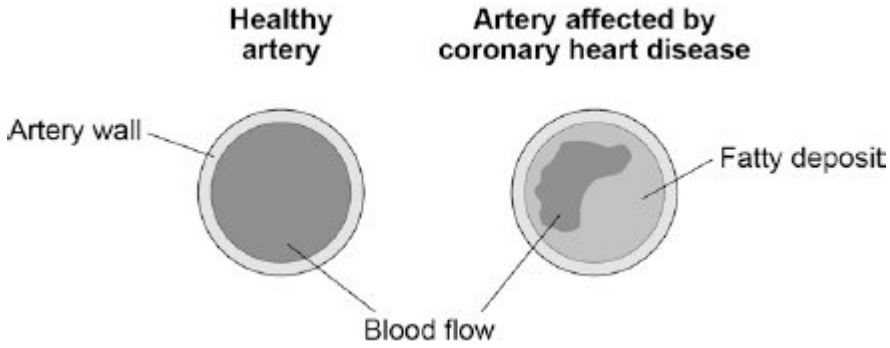
(c) Circle a valve on **Figure 1**.

(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 ☐

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Hormones ☐

Statins ☐

Stent ☐

Vaccination ☐

(2)

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

1. _____

_____

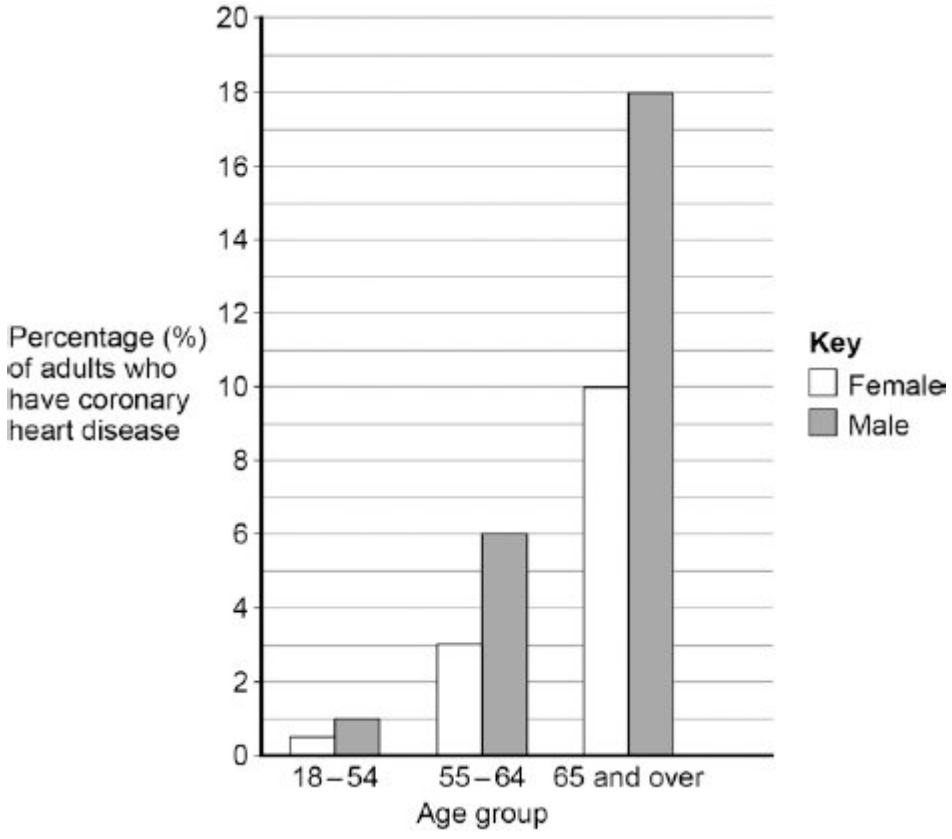
2. _____

_____

(2)

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

Figure 3



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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:

hydrogen peroxide → water + oxygen

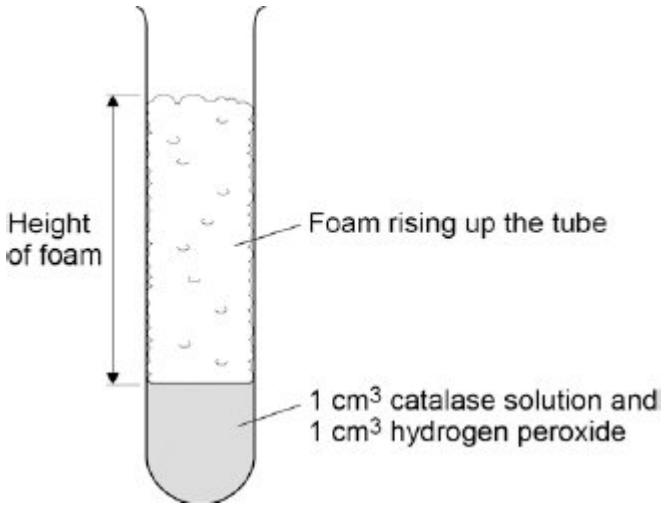
A student did an investigation on catalase activity.

This is the method used.

1. Put 1 cm^3 hydrogen peroxide solution in a test tube.
2. Add 1 cm^3 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.

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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?

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_____

_____

(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 ☐

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Use less hydrogen peroxide solution ☐

Use more catalase solution ☐

(1)

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

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 10 marks)

Q18.

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

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

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

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

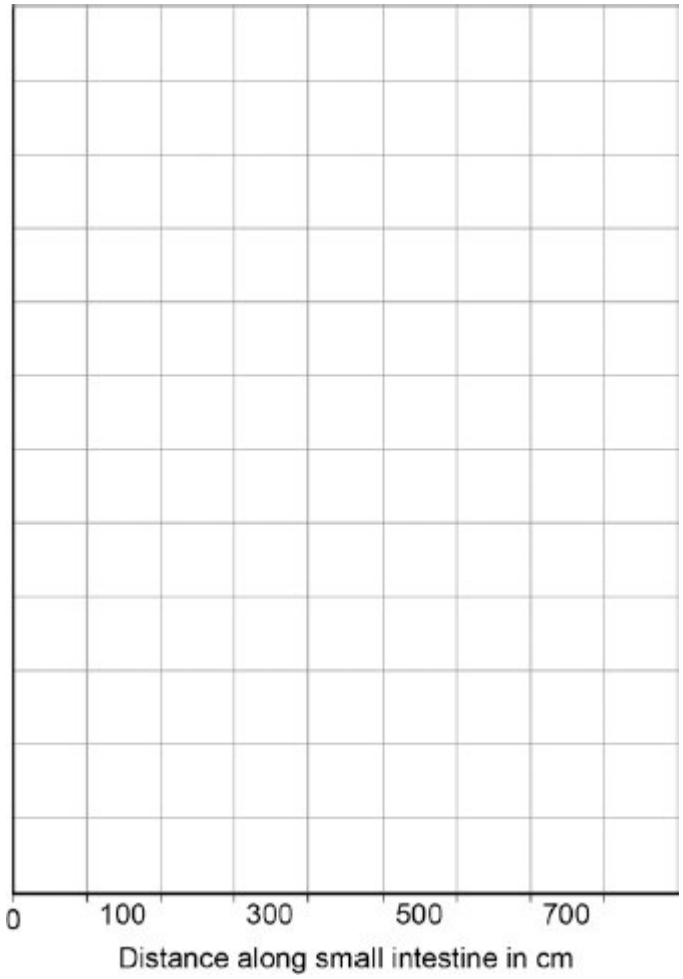
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_____ cm

(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.

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_____

_____

_____

_____

_____

_____

(2)

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

_____

_____

_____

_____

_____

_____

_____

_____

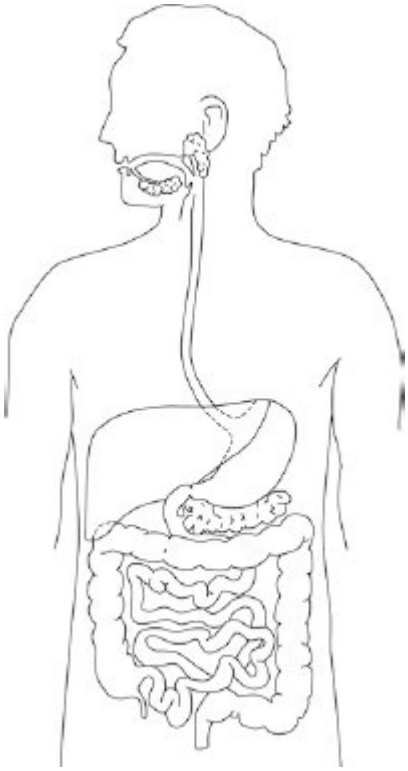
(3)

(Total 12 marks)

Q19.

The diagram below shows the human digestive system.

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(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.

_____

_____

_____

_____

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_____

_____

(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.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 12 marks)

Q20.

Explain how the human circulatory system is adapted to:

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

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

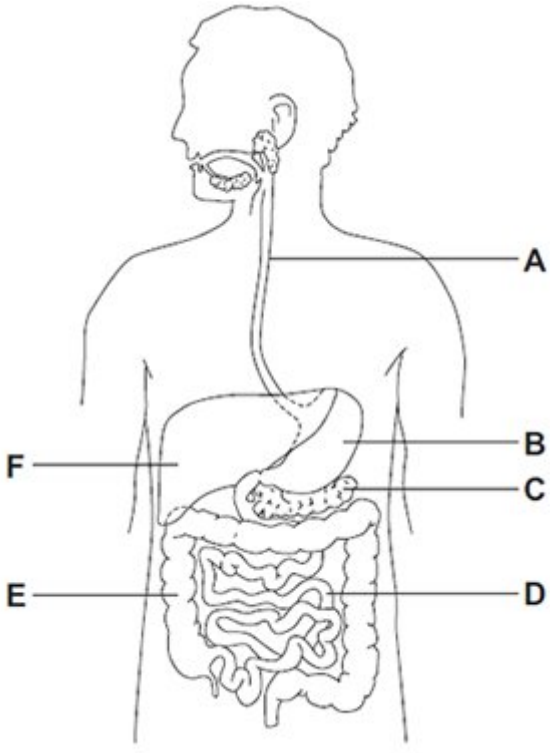
(Total 6 marks)

Q21.

The digestive system breaks down food into small molecules.

The small molecules can be absorbed into the blood.

The diagram below shows the human digestive system.



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

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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. ☐

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The concentration in the blood is the same. ☐

(1)

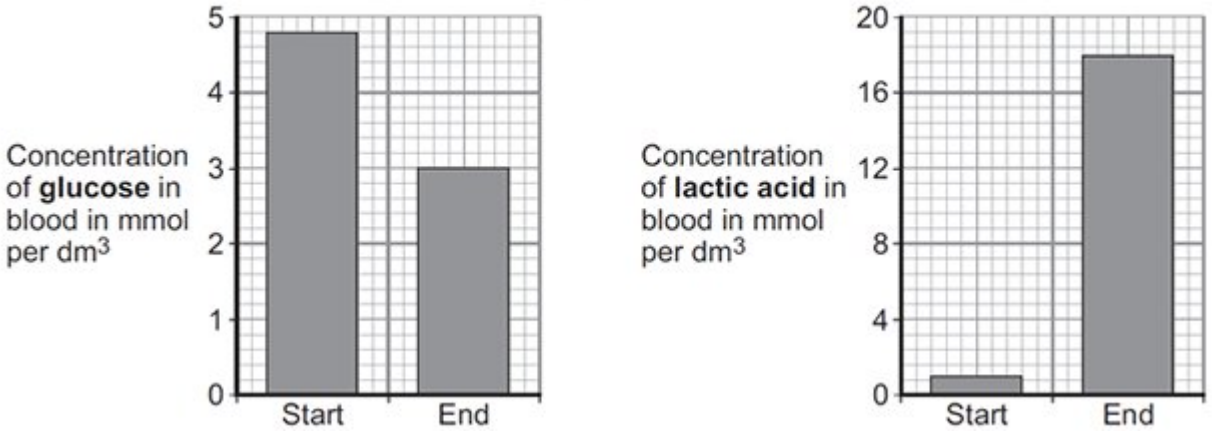
(Total 7 marks)

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.

_____

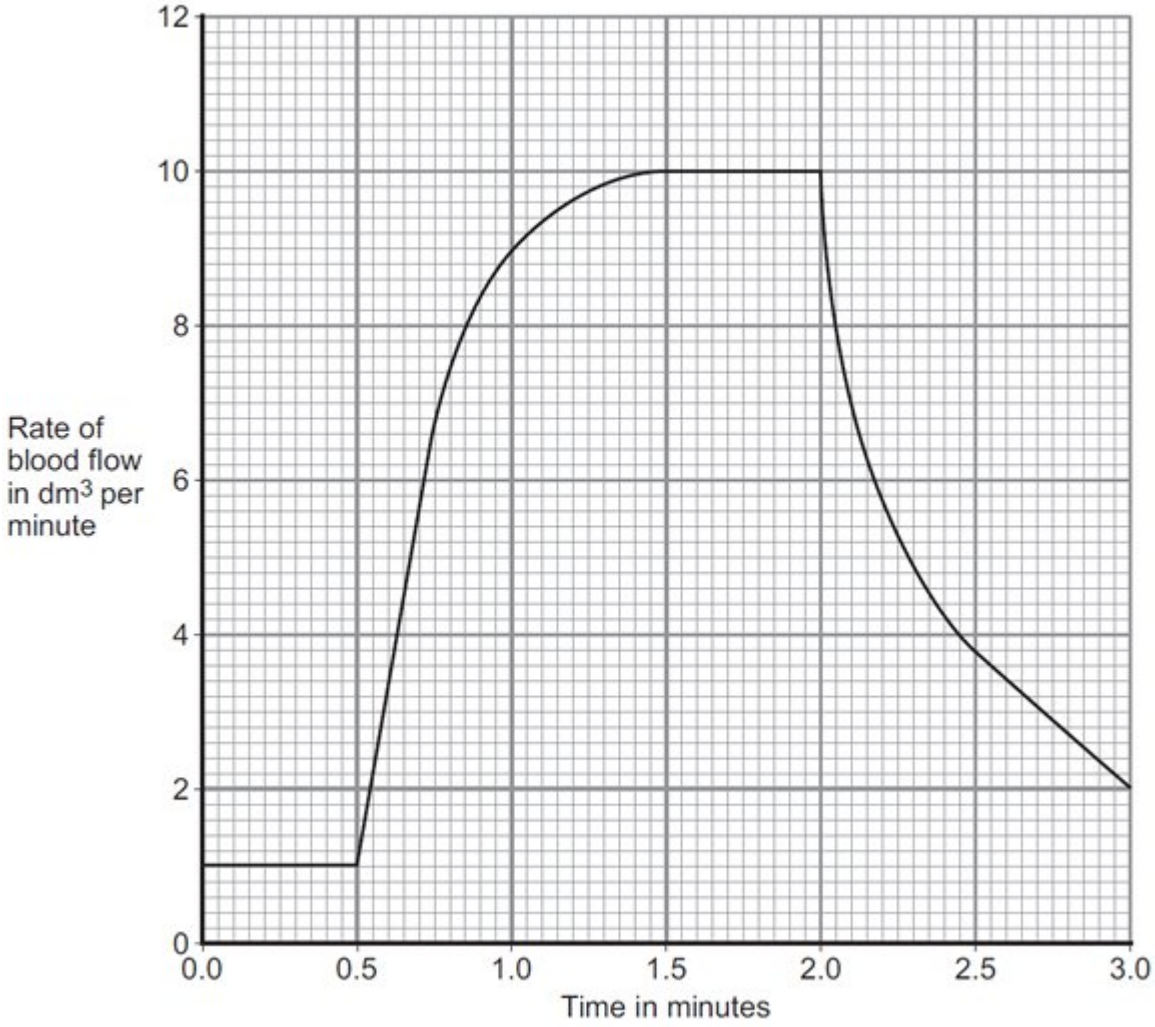
_____

(1)

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

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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)

(iii) Explain how the change in blood flow to the athlete's muscles helps him to run.

_____

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_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 9 marks)

Q23.

Enzymes are made and used in all living organisms.

(a) What is an enzyme?

_____

_____

_____

_____

(2)

(b) Many enzymes work inside cells.

In which part of a cell will most enzymes work?

Draw a ring around the correct answer.

cell membrane **cytoplasm** **nucleus**

(1)

(c) We can also use enzymes in industry.

Hydrogen peroxide is a chemical that can be used to preserve milk.

Adding a small amount of hydrogen peroxide to the milk kills the bacteria that cause decay. Hydrogen peroxide does not kill all disease-causing bacteria.

The enzyme catalase can be added later to break down the hydrogen peroxide to oxygen and water.

A different way of preserving the milk is by heating it in large machines to 138 °C for a few seconds.

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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 _____

_____

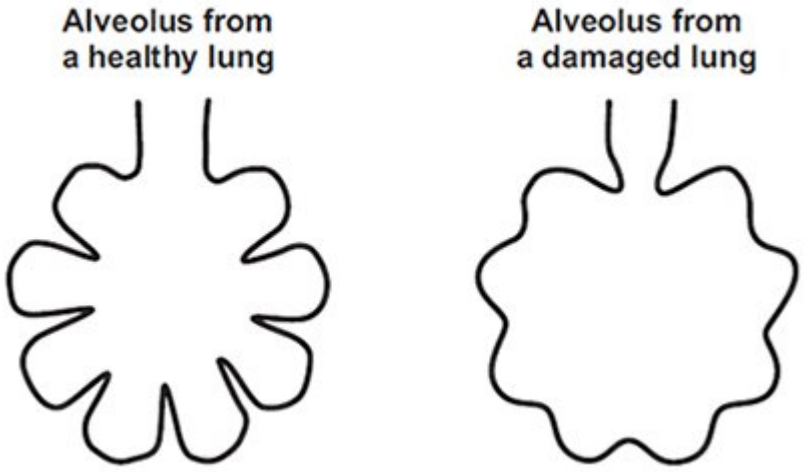
_____

(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.

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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)

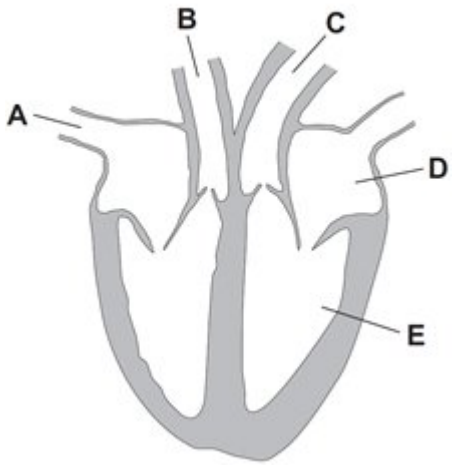
(ii) What is the main type of tissue in the heart wall?

_____

(1)

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

Figure 1



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

(1)

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

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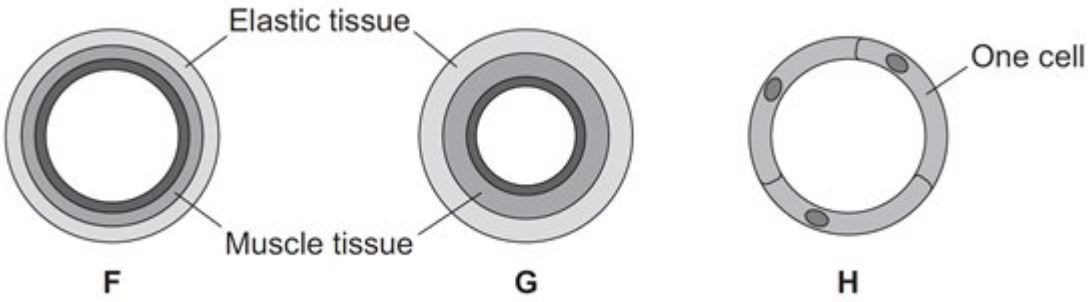
D _____

E _____

(2)

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

Figure 2



(i) What type of blood vessel is **F?**

Tick (✔) **one** box.

an artery ☐

a capillary ☐

a vein ☐

(1)

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

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

Tick (✔) **one** box.

an artery ☐

a capillary ☐

a vein ☐

(1)

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

_____

_____

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_____

_____

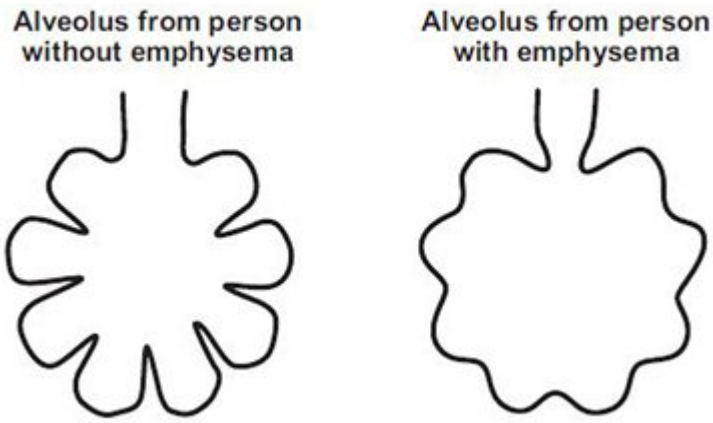
(2)

(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.

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(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)

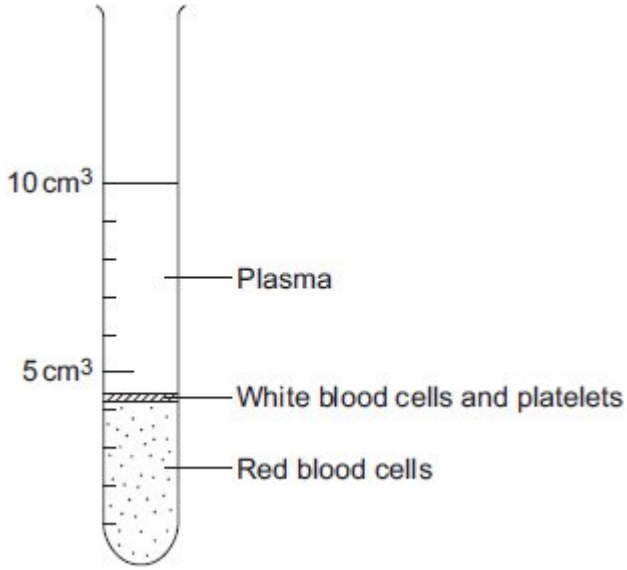
(Total 6 marks)

Q28.

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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 cm^3 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. _____

(3)

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

White blood cells are part of the immune system. White blood cells help the body to defend itself against pathogens.

Describe how pathogens cause infections **and** describe how the immune system defends the body against these pathogens.

_____

_____

_____

_____

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_____

_____

_____

_____

_____

_____

(6)

(Total 11 marks)

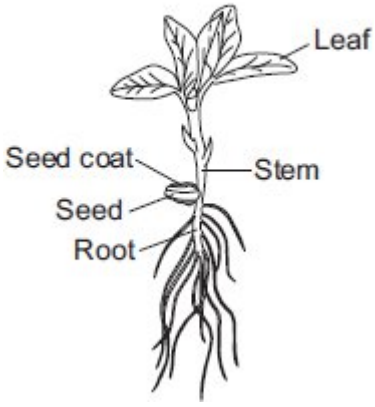
Q29.

Catalase is an enzyme found in many different tissues in plants and animals. It speeds up the rate of the following reaction.

$$\text{hydrogen peroxide} \xrightarrow{\text{catalase}} \text{water + oxygen}$$

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:

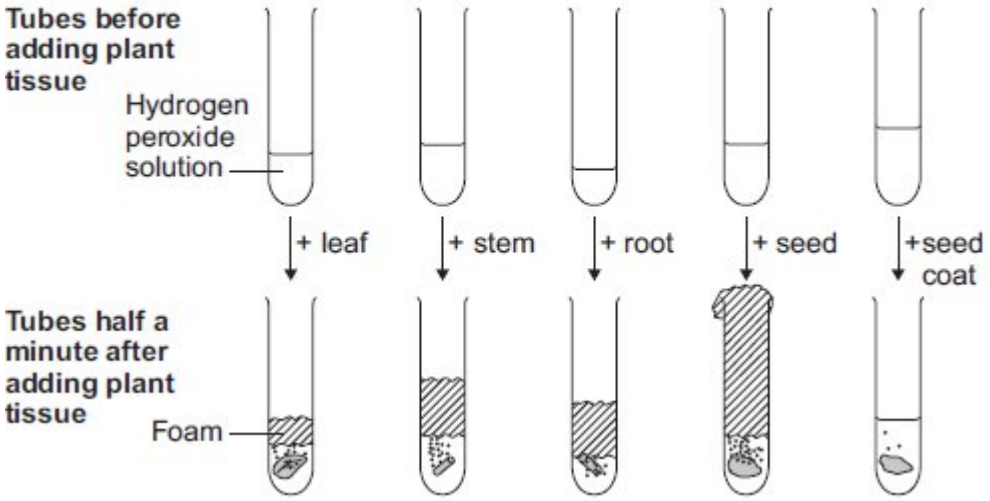
- put hydrogen peroxide into five test tubes
- added a different part of a bean seedling to each tube
- recorded the results after half a minute.

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.

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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.

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_____

(6)

(b) Scientists investigated the effect of pH on the activity of the enzyme catalase in a fungus.

The table below shows the scientists' results.

pH	Enzyme activity in arbitrary units					
	Test 1	**Test 2**	**Test 3**	**Test 4**	**Test 5**	**Mean**
3.0	0	0	0	0	0	0
4.0	6	5	8	4	7	6
5.0	38	65	41	42	39	
5.5	80	86	82	84	88	84
6.0	100	99	96	103	102	100
6.5	94	92	90	93	91	92
7.0	61	63	61	62	63	62
8.0	22	22	21	24	21	22

(i) Calculate the mean enzyme activity at pH 5.0.

_____

_____

Mean = _____ arbitrary units

(2)

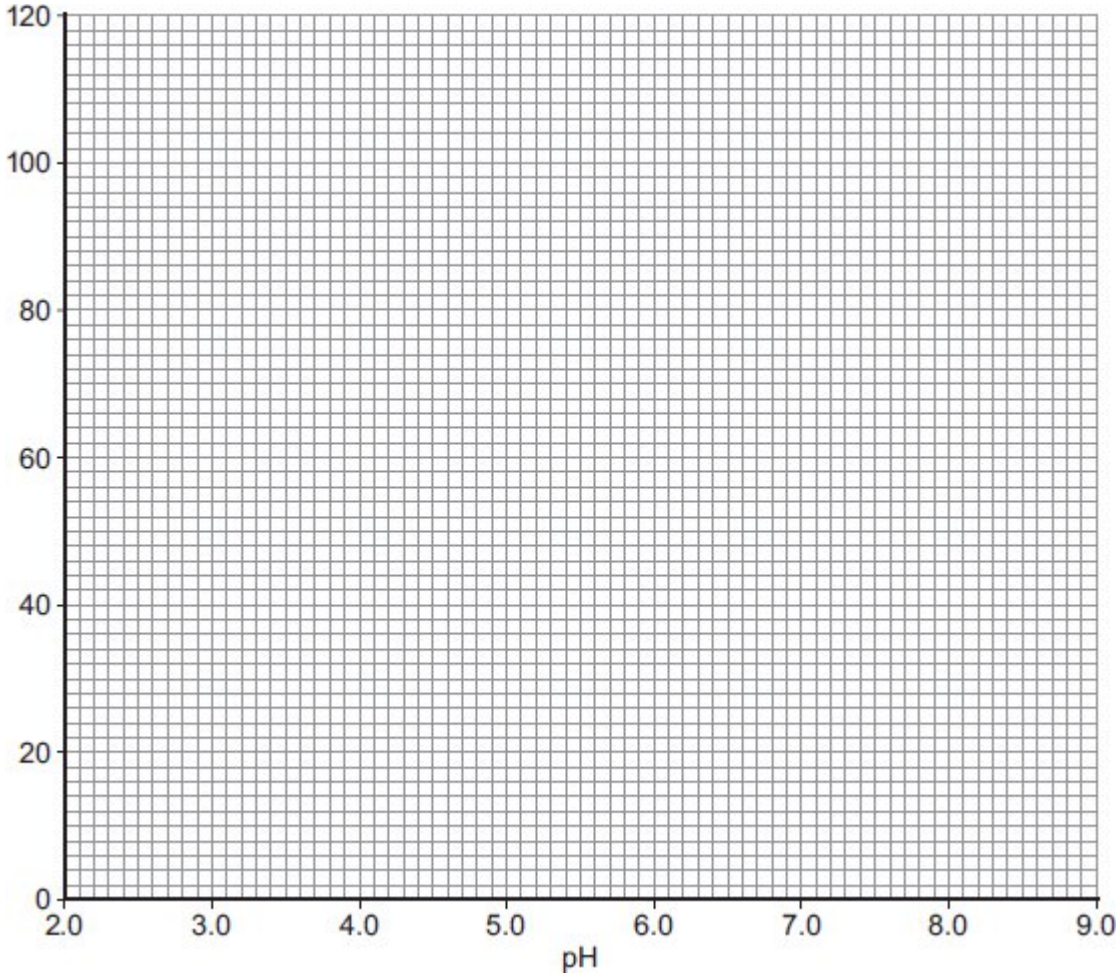
(ii) On the graph paper in **Figure 3**, draw a graph to show the scientists' results.

Remember to:

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

Figure 3

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(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)

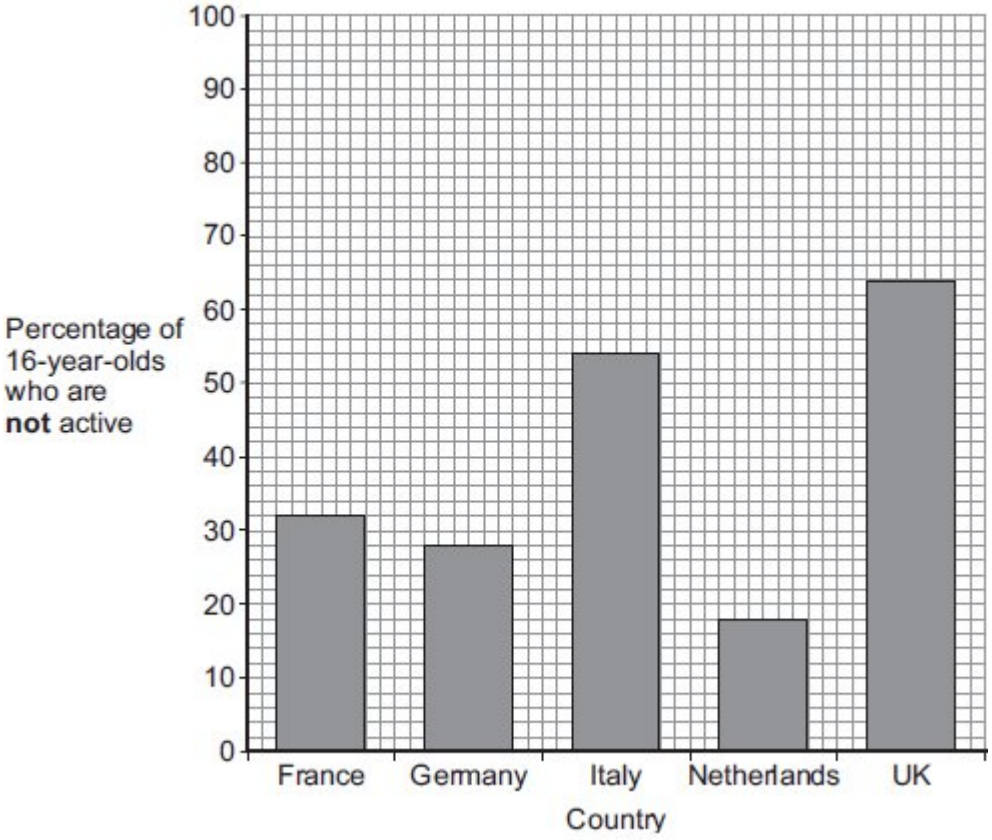
Q30.

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.

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(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	**Health rating**

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done in minutes every week	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.

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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.

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glucose	glycerol	glycogen

fat $\xrightarrow{\text{lipase}}$ fatty acids + _____

(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. _____

_____

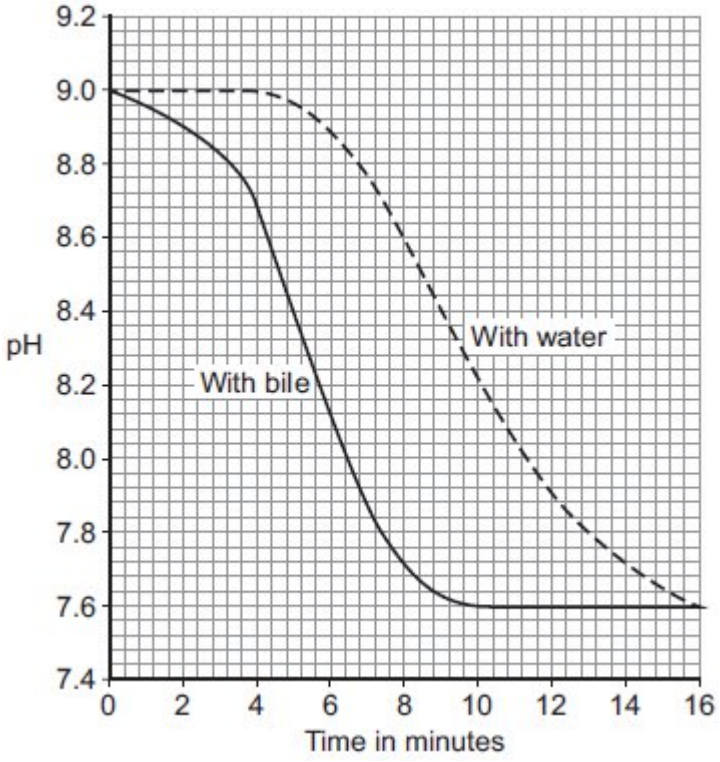
2. _____

_____

(2)

(c) The graph shows the students' results.

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(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.

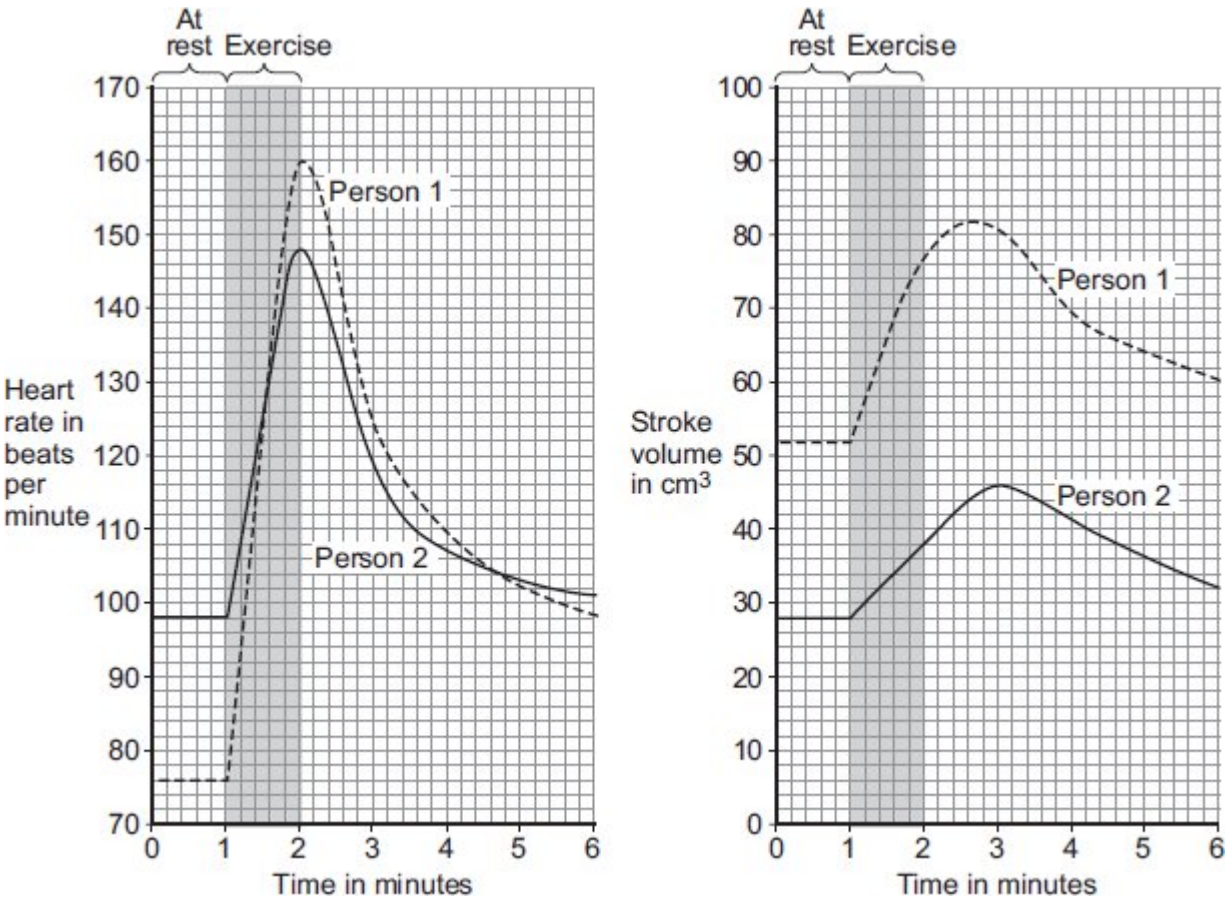
During exercise, the heart beats faster and with greater force.

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'.

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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.

Cardiac output = Heart rate × Stroke volume

At the end of the exercise, **Person 1**'s cardiac output = 160 × 77 = 12 320 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 lower cardiac output of **Person 2**.

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_____

_____

(1)

(ii) **Person 1** was able to run much faster than **Person 2**.

Use information from the figure above and your own knowledge to explain why.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

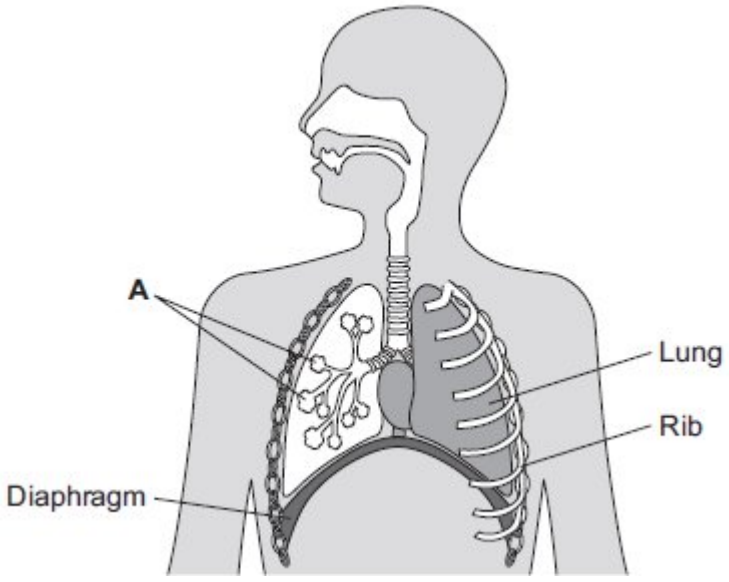
(5)

(Total 9 marks)

Q34.

Our lungs help us to breathe.

The image below shows the human breathing system.



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

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_____

(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 ☐

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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 dm^3.

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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.

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Giving the patient antibodies ☐

Giving the patient painkillers ☐

Tissue typing the donor kidney ☐

(1)

(Total 8 marks)

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