AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
BIOLOGY

H

Higher Tier Paper 1H

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

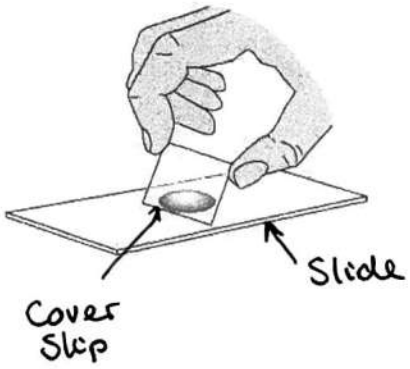
Answer **all** questions in the spaces provided.

Do not write outside the box

0 1 A student prepared some animal cells to view using a microscope.

Figure 1 shows the student preparing the cells.

Figure 1



0 1 . 1 Name **two** pieces of laboratory equipment the student could have used to **prepare** cells to view using a microscope.

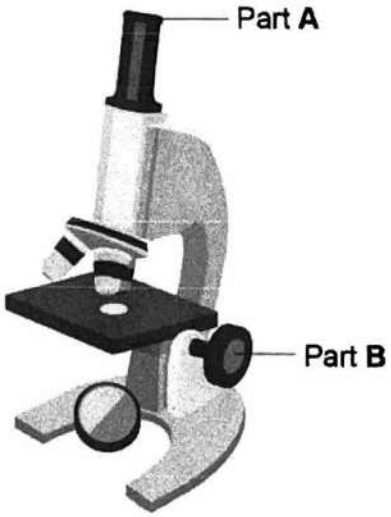
[2 marks]

1 slide

2 cover slip

Figure 2 shows the student's light microscope.

Figure 2



0 1 . 2 Name part **A**.

[1 mark]

eyepiece / lens

0 1 . 3 What is the function of part **B**?

[1 mark]

allow movement of the sample slowly up and down to focus the image

0 1 . 4 The student tried to look at the cells using the microscope.

Suggest **one** reason why the student could **not** see any cells when looking through part **A**.

[1 mark]

Microscope may not be focused on the sample

OR mirror is not adjusted to shine light onto the sample

Question 1 continues on the next page

Do not write outside the box

0 1 . 5 Red blood cells are specialised animal cells.

Compare the structure of a red blood cell with the structure of a plant cell.

[6 marks]

Both cells are eukaryotic cells, containing a cytoplasm and a cell membrane.
However, their similarities stop there as they differ in several other aspects. For instance plant cells have a cell wall, a nucleus and chlorophyll, which are cell structures not present in a red blood ~~cell~~ cell. But red blood cells do have haemoglobin which plant cells do not have.
They also differ in terms of shape and size. Red blood cells have a biconcave shap and are significantly smaller than plant cells. ~~Plant cells~~ This is because of their singular specialised function to carry oxygen. Plant cells on the other hand come in all shapes and sizes, carrying out different functions.

0 1 . 6 When placed into a beaker of water:

- a red blood cell bursts
- a plant cell does **not** burst.

Explain why the red blood cell bursts but the plant cell does **not** burst.

[2 marks]

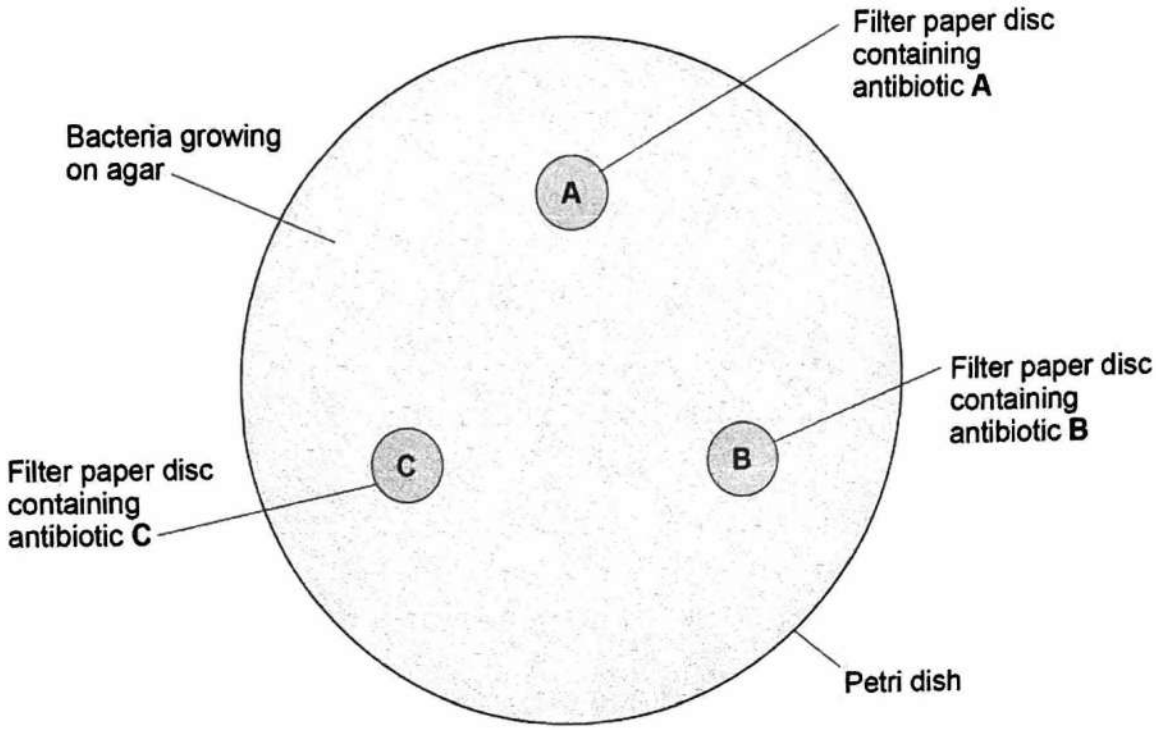
There is a higher concentration of water outside, so water moves into the cells by osmosis. Plant cells have a cell wall that prevents them from bursting, while red blood cells dont, so they burst.

13

0 2 A student investigated the effectiveness of three different antibiotics.

Figure 3 shows how the student set up an agar plate.

Figure 3



The student used aseptic techniques to make sure that only one type of bacterium was growing on the agar.

0 2 . 1 Describe **two** aseptic techniques the student should have used.

[2 marks]

1 Should sterilise all equipment used and all surfaces worked on before the experiment.

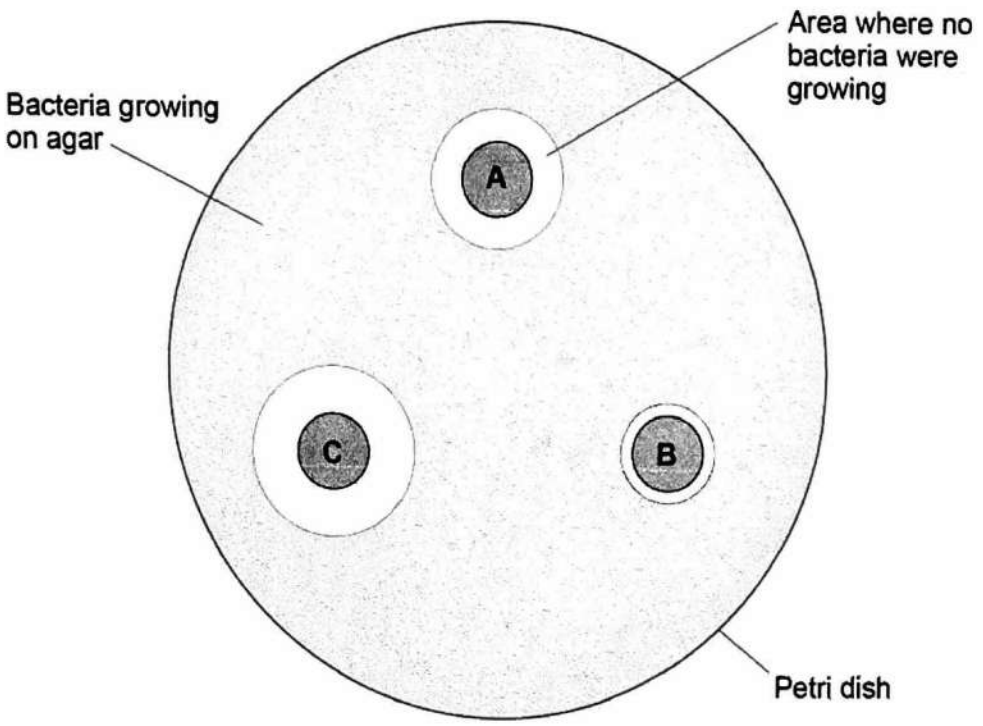
2 Secure the lid with tape onto the petri dish to prevent any bacteria getting in while it's incubating

Question 2 continues on the next page

The student placed the agar plate in an incubator at 25 °C for 48 hours.

Figure 4 shows the agar plate after 48 hours.

Figure 4



0 2 . 2 Which antibiotic is the **least** effective?

Give a reason for your answer.

[1 mark]

Least effective antibiotic B

Reason Has the smallest 'zone of inhibition' around it. This is the white area around the disc in which bacteria was killed.

0 2 . 3 Calculate the area where no bacteria were growing for antibiotic **C**.

Use $\pi = 3.14$

Give the unit.

[5 marks]

diameter measured from Figure 4 = 22mm

⇒ radius = 11mm

Area of circle = πr^2

$= 3.14 \times (11mm)^2$

$= 3.14 \times 121 mm^2$

$= 379.94 mm^2$

Area = 379.94 Unit mm^2

0 2 . 4 Suggest **one** way the student could improve the investigation.

[1 mark]

They could repeat the experiment several times allowing them to exclude anomalies and calculate a mean.

9

Turn over for the next question

0 3 Body Mass Index (BMI) is a way of finding out if a person's body mass falls within a healthy range for their height.

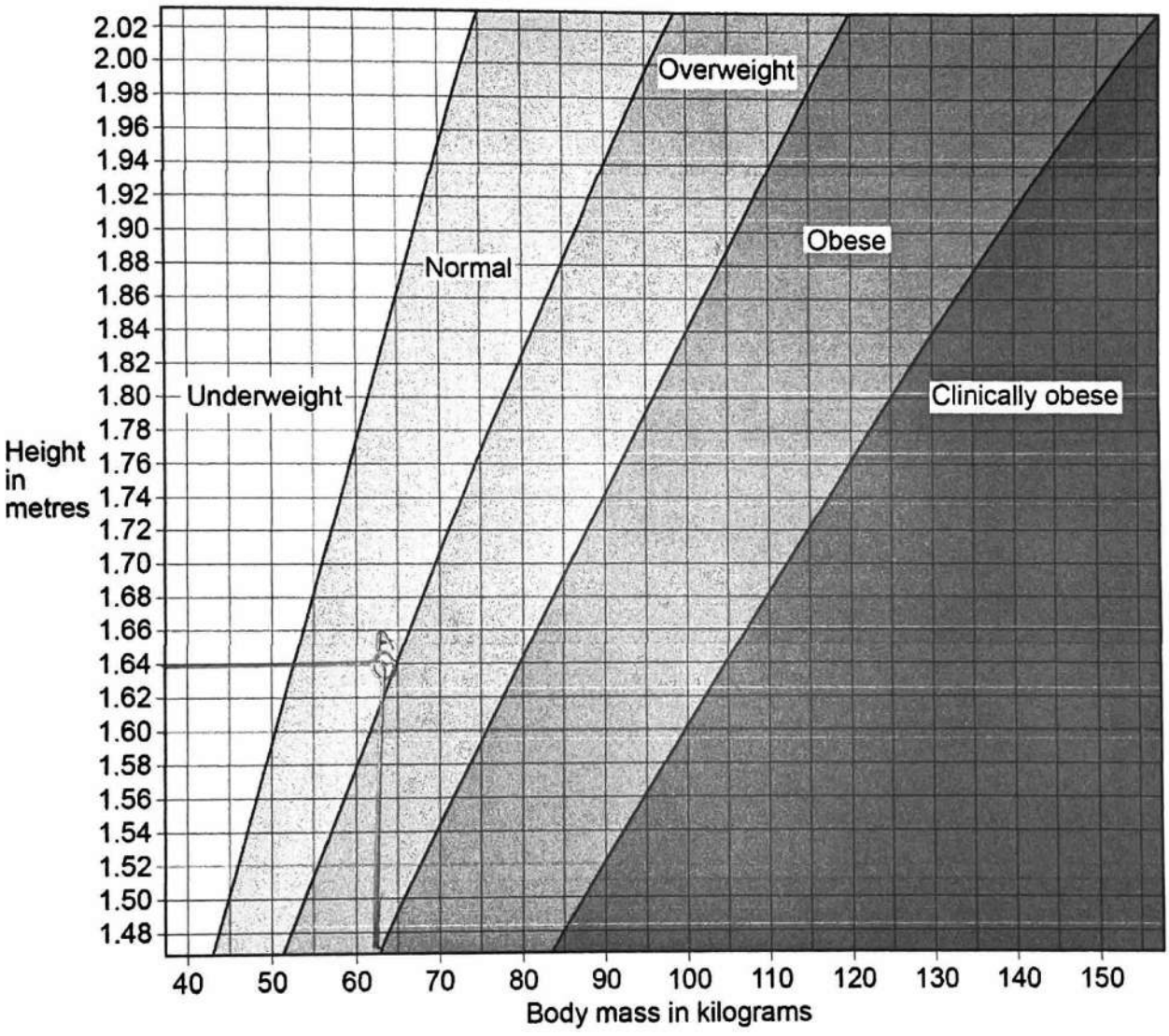
Table 1 shows information about two people.

Table 1

Person	Body mass in kg	Height in m	BMI in kg/m²
A	63	1.65	23.1
B	92	1.71	X

Figure 5 shows five BMI categories for adults.

Figure 5



Do not write outside the box

0 3 . 1 Which is the BMI category of person **A** in **Table 1**?

[1 mark]

Tick (✓) **one** box.

Clinically obese	☐
Normal	✓ see graph
Obese	☐
Overweight	☐
Underweight	☐

0 3 . 2 Calculate value **X** in **Table 1**.

Use the equation:

$$\text{BMI} = \frac{\text{body mass}}{\text{height}^2}$$

Give your answer to 3 significant figures.

[3 marks]

$BMI = \frac{92\,kg}{(1.71\,m)^2} = \frac{92\,kg}{2.9241\,m^2}$

$= 31.46267228\ldots\ kg/m^2$

3sf $\Rightarrow$ $31.5\ kg/m^2$

X = 31.5 kg/m²

Question 3 continues on the next page

Do not write outside the box

Scientists think there is a link between BMI and life expectancy.

Table 2 shows information about predicted life expectancy of men after the age of 50.

Table 2

BMI Category	Predicted number of years living in good health after the age of 50	Predicted number of years living in bad health after the age of 50
Normal	19.06	4.98
Overweight	18.68	5.32
Obese	16.37	7.08
Clinically obese	13.07	10.10

0 3 . 3 Describe **two** patterns shown in **Table 2** about the effects of BMI category.

[2 marks]

1 The highest the BMI category, the lower the number of years they have to live in good health

2 The higher the BMI category, the higher the number of years they have to live in bad health

Do not write outside the box

The number of people who are obese in the UK is increasing.

0 3 . 4 Explain the financial impact on the UK economy of an increasing number of people who are obese.

[2 marks]

Place a financial strain on health services as they need to pay for the care, treatments and drugs who suffer with obesity, and furter complications obesity may cause. Obese people may be less able to work and have to take time off more frequently.

0 3 . 5 A person who is obese is more at risk of arthritis.

Arthritis is a condition that damages joints.

Suggest how arthritis could affect a person's lifestyle.

[1 mark]

Joints are vital for movement. Damage to joints can lead to mobility issues.

0 3 . 6 A person who eats a diet high in saturated fat might become obese.

Name **two** health conditions that might develop if a person eats a diet high in saturated fat.

Do **not** refer to arthritis in your answer.

[2 marks]

1 CHD (coronary heart disease)

2 type 2 diabetes (developed through life)

11

Turn over for the next question

0 4 All living organisms respire.

0 4 . 1 What is the chemical equation for aerobic respiration?

[1 mark]

Tick (✓) **one** box.

$6O_2 + 6CO_2 \rightarrow 6H_2O + C_6H_{12}O_6$ ☐

$6H_2O + C_6H_{12}O_6 \rightarrow 6H_2O + 6CO_2$ ☐

$6H_2O + 6CO_2 \rightarrow 6O_2 + C_6H_{12}O_6$ ☐

$6O_2 + C_6H_{12}O_6 \rightarrow 6H_2O + 6CO_2$ ✓

Oxygen + glucose → water + carbon dioxide

0 4 . 2 Name the sub-cellular structures where aerobic respiration takes place.

[1 mark]

mitochondria

0 4 . 3 Energy is released in respiration.

Give **two** uses of the energy released in respiration.

[2 marks]

1 Some of the released energy is in the form of heat allowing the body to keep warm.

2 contraction of muscles leading to movement requires energy.

Do not write outside the box

0 4 . 4 Describe **two** differences between aerobic and anaerobic respiration in humans.

Do **not** refer to oxygen in your answer.

[2 marks]

1 anaerobic respiration produces lactic acid while aerobic produces carbon dioxide and water.

2 aerobic respiration releases significantly more energy than anaerobic

0 4 . 5 What are the **two** products of anaerobic respiration in plant cells?

[2 marks]

Tick (✓) **two** boxes.

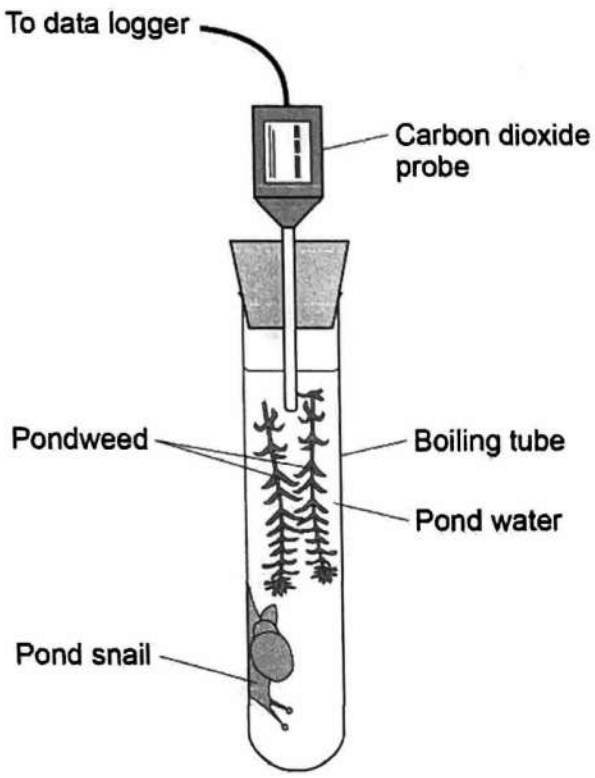
Carbon dioxide	✓
Ethanol	✓
Glucose	
Lactic acid	
Water	

Question 4 continues on the next page

A scientist investigated respiration and photosynthesis using some pondweed and a pond snail.

Figure 6 shows the apparatus used.

Figure 6



The apparatus was left in a well-lit room for 5 days.

The data logger recorded the concentration of carbon dioxide continuously.

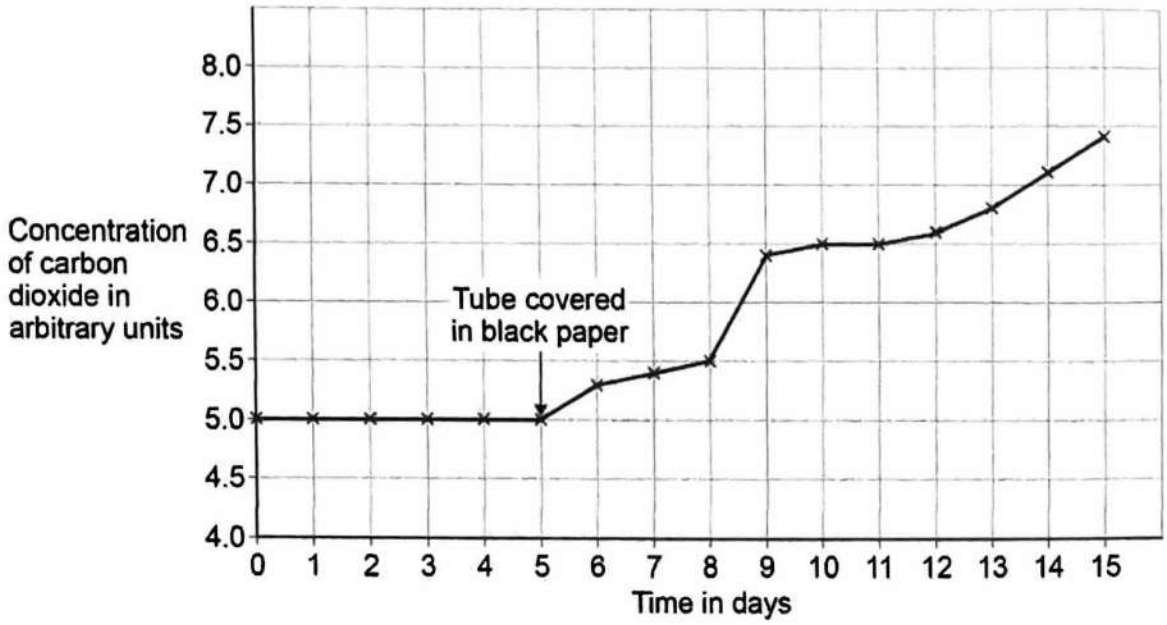
After 5 days, the scientist completely covered the boiling tube with black paper.

The data logger continued to record the concentration of carbon dioxide.

Do not write outside the box

Figure 7 shows the concentration of carbon dioxide inside the boiling tube over 15 days.

Figure 7



0 4 . 6 Explain why the concentration of carbon dioxide in the tube stayed the same between day 0 and day 5.

[2 marks]

The respiration by the snail and the pondweed produces CO_2. While photosynthesis by the ~~pest~~ pondweed takes up CO_2. The rate of ~~total photosynthe~~ CO_2 take up and CO_2 production was equal.

0 4 . 7 Suggest why the concentration of carbon dioxide increased between day 5 and day 10.

[1 mark]

All light was blocked out by the paper. Without light no photosynthesis could take place, so no CO_2 was taken up. However, respiration by the snail and the pondweed continued producing and releasing more CO_2.

Question 4 continues on the next page

0 4 . 8 On day 10, the pond snail died.

Explain why the death of the pond snail caused the concentration of carbon dioxide to increase after day 10.

[3 marks]

Dead snail is being decomposed / broken down by decomposers, such as bacteria. Decomposers metabolise dead matter respiring CO_2 from it, hence releasing further CO_2 from their respiration.

14

Do not write outside the box

0 5 Amylase is an enzyme that breaks down starch.

0 5 . 1 Amylase is a polymer of smaller molecules.

Name the type of smaller molecule.

[1 mark]

amino acids (building blocks of proteins)

0 5 . 2 Name the **three** parts of the human digestive system that produce amylase.

[2 marks]

1 Salivary gland

2 pancreas

3 small intestine

0 5 . 3 Explain how amylase breaks down starch.

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

[3 marks]

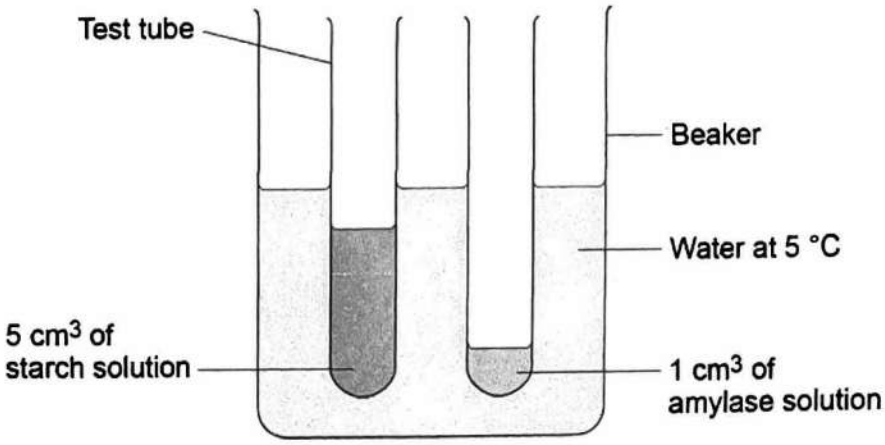
Amylase has a special active site on its surface that is complementary to the shape of starch so can bind to it. ~~Amylase~~ Amylase ~~catalyses~~ catalyses the breaking of chemical bonds between smaller sugar molecules, breaking down starch into its monomers.

Question 5 continues on the next page

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

Figure 8 shows the apparatus used.

Figure 8



This is the method used.

1. Set up the apparatus as shown in **Figure 8**.
2. After 5 minutes, pour the starch solution into the amylase solution and mix.
3. Remove one drop of the starch-amylase mixture and place onto a spotting tile.
4. Immediately add two drops of iodine solution to the starch-amylase mixture on the spotting tile.
5. Record the colour of the iodine solution added to the starch-amylase mixture.
6. Repeat steps 3 to 5 every minute until the iodine solution stays yellow-brown.
7. Repeat steps 1 to 6 using water at different temperatures.

0 5 . 4 Name **two** control variables the student used in the investigation.

[2 marks]

1 Same volume of amylase solution - 1 cm^3

2 Same number of drops of iodine solution added - 2 drops

0 5 . 5 Why did the student leave the starch solution and amylase solution for 5 minutes before mixing them?

[1 mark]

Allow both solutions to reach a stable ~~common~~ common temperature,

Question 5 continues on the next page

Do not write outside the box

Table 3 shows the results of the investigation.

Table 3

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

0 5 . 6 What conclusion can be made about the effect of temperature on amylase activity between 20 °C and 65 °C?

[1 mark]

Activity increases with temperature up to 35°, after which it decreases more and more as temperature increases.

Do not write outside the box

0 5 . 7 Explain the results at 5 °C and at 80 °C.

Use **Table 3**.

[5 marks]

Iodine did not turn yellow-brown as starch is still present in the solution, hasn't been broken down by amylase.

At 5°C temperature is to low, so particles have very low amount of kinetic energy. This means very few successfull collisions and enzyme-substrate complexes formed. So starch break down cant happen.

At 80°C the temperature is to high causing amylase to denature. This changes the active site of amylase, so it can no longer fit starch and break it down. So starch wont get broken down.

0 5 . 8 The student investigated the effect of temperature on amylase activity.

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

[2 marks]

They could keep the temperature constant and only change a different factor like pH. By testing the activity of amylase at a range of pH's values.

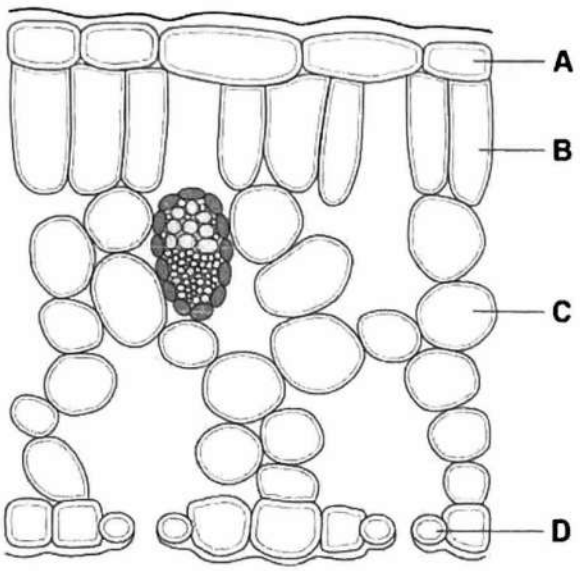
17

Turn over for the next question

Do not write outside the box

0 6 **Figure 9** shows a cross section of a leaf.

Figure 9



0 6 . 1 Which cell is most transparent?

[1 mark]

Tick (✓) **one** box.

A ☑ B ☐ C ☐ D ☐

need to let light through to photosynthetic cells (B) bellow

0 6 . 2 Which cell structure in a leaf mesophyll cell is **not** found in a root hair cell?

[1 mark]

Chloroplast

(chlorophyll is not a cell structure, but a pigment in chloroplast)

Do not write outside the box

Plants lose water through their leaves.

0 6 . 3 Name the cells in a leaf that control the rate of water loss.

[1 mark]

guard cells (control the opening and closing of the stomata)

0 6 . 4 Water is taken in by the roots, transported up the plant and lost from the leaves.

Which scientific term describes this movement of water?

[1 mark]

transpiration stream

0 6 . 5 Which change would decrease the rate of water loss from a plant's leaves?

[1 mark]

Tick (✓) **one** box.

- Increased humidity ☑ higher humidity lower concentration gradient between the inside and the outside of the leaf.
- Increased light intensity ☐
- Increased density of stomata ☐
- Increased temperature ☐

Question 6 continues on the next page

0 6 . 6 Compare the structure and function of xylem tissue and phloem tissue.

[6 marks]

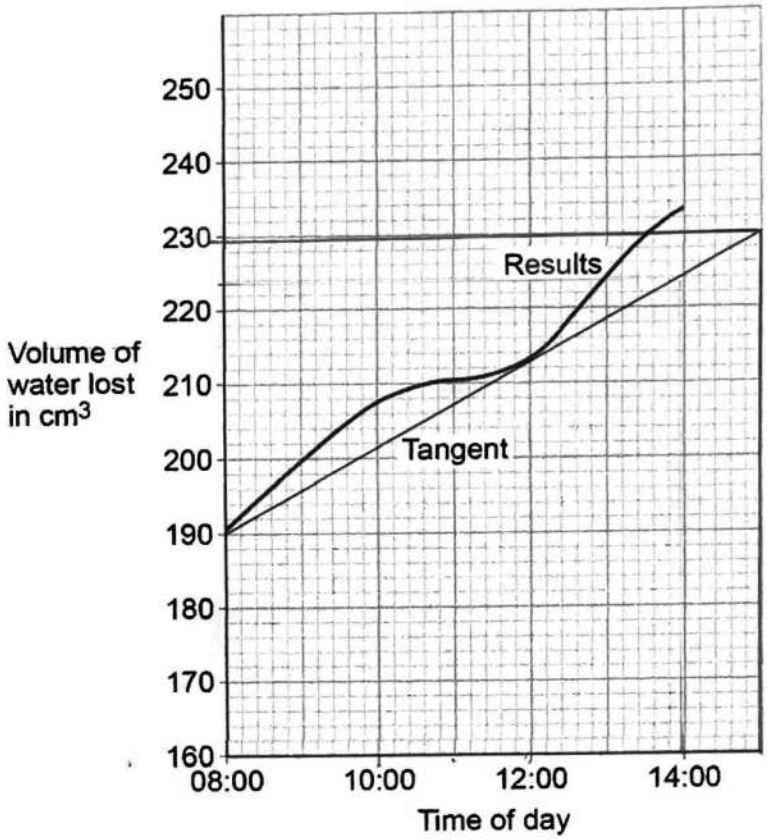
Xylem cells are hollow, dead cells containing lignin. While phloem cells are alive and not hollow as they contain cytoplasm. They do not contain lignin, but unlike xylem cells have pores at their end walls. Both xylem and phloem cells are made up of cells and tubular forming the vascular bundle of the plant.

The xylems function is to transport water and mineral ions from the root to out other parts of the plant. This is done unidirectionally upwards through the process of transpiration. On the other hand, phloem is involved in translocation, which is bidirectional, transporting sugars up and down the plant. However both transport a liquid medium throughout thee whole plant.

Do not write outside the box

Figure 10 shows the total volume of water lost from a plant over 6 hours.

Figure 10



0 6 . 7 Determine the rate of water loss at 12:00

Use the tangent on **Figure 10**.

Give your answer:

- in cm^3 per minute
- in standard form.

[4 marks]

08:00 - 190 cm^3 → 08:00 to 15:00 is 7 hours

~~[redacted]~~ → 190 cm^3 → 230 cm^3 ⇒ 40 cm^3 change

15:00 - 230 cm^3

40 cm^3 is per 7 hours

40 ÷ 7 = 5.714285 cm^3 is per 1 hour

60 min = 1h

5.714285 cm^3 ÷ 60 = 0.095238 cm^3 / min

standard form = 9.5×10^{-2} cm^3 / min

Rate of water loss = 9.5×10^{-2} cm^3 per minute

0 6 . 8 The rate of water loss at midnight was much lower than at 12:00

Explain why.

[2 marks]

Less water loss at night as the stomata are closed as no photosynthesis is happening due to no light at night.

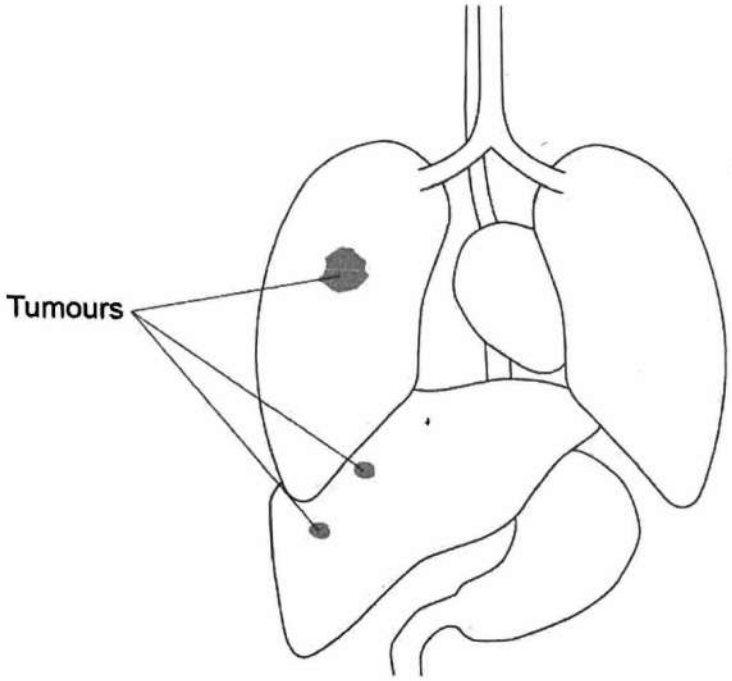
17

Turn over for the next question

Do not write outside the box

0 7 **Figure 11** shows where three of the same type of tumour were found in a patient.

Figure 11



Malignant tumours are cancers.

0 7 . 1 Describe what happens to cells when a tumour forms.

[1 mark]

Tumour cells are cells that grow and divide abnormally, get out of control

0 7 . 2 What evidence is there in **Figure 11** to suggest that the tumour in the lung is malignant?

[1 mark]

It has spread to other parts of the body, from the lungs to the liver.

Do not write outside the box

0 7 . 3 Some types of cancer can cause the numbers of blood components in a person's body to fall to a dangerously low level.

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

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

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

[6 marks]

Tiredness can be caused by fewer red blood cells, which therefore can only transport less oxygen around the body. As organs don't recive enough oxygen they function less effectively leading to tiredness.

Frequent infections could be due to decrease white blood cell numbers. White blood cells are responsible for phagocytosis and antibody production, which is a vital part of an immune response. Fewer white blood cells will be less effective in stopping phatogens invading the body.

Platelets are responsible for blood clotting and stopping bleeding. If these are low in number any cuts or bruises will not clotk easily leading to dangerous and excessive bleeding.

Question 7 continues on the next page

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

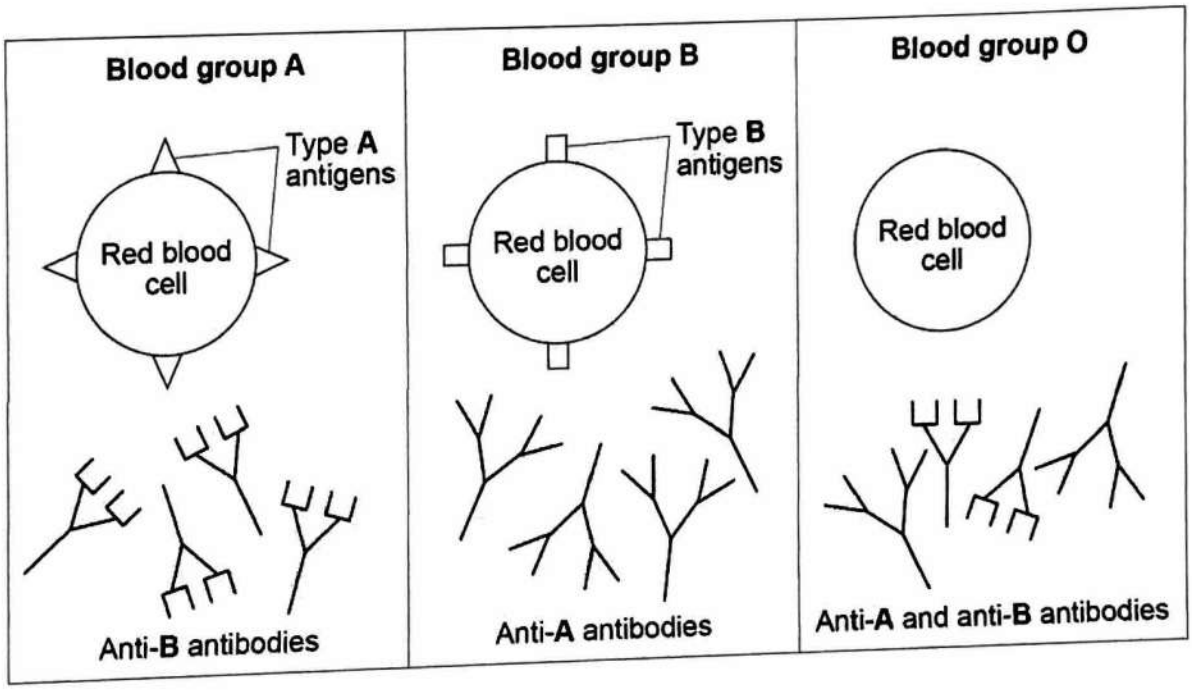
A blood transfusion is where a patient receives blood from a donor.

Different people have different blood groups.

Figure 12 shows:

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

Figure 12



Antibodies can bind to antigens that have complementary shapes.

When antibodies bind to the antigens on red blood cells, many red blood cells begin to clump together.

Each red blood cell is about 8 μm in diameter.

Many capillaries have an internal diameter of about 10 μm.

Do not write outside the box

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

0 7 . 4 It is dangerous for a patient with blood group **A** to receive red blood cells from a donor with blood group **B**.

Explain why.

[3 marks]

The red blood cells from a donor in group will have type B antigens on its surface. The group A patient will have Anti-B antibodies which will bind to the B antigens on the surface of the red blood cells. This causes these blood cells to clump which is bigger then Cappillary diameters, blocking cappillaries off. This blocks of oxygen flow to cells who cant respire and die of due to lack of oxygen.

0 7 . 5 Explain why blood group **O** red blood cells can be given to patients with any blood group.

[2 marks]

group O red blood cells have neither A or B antigen on their surface. So no antibodies will bind to group O red blood cells, therefore, no clumping will occur.

Question 7 continues on the next page

0 7 . 6 **Table 4** shows some of the risks associated with blood transfusions.

Table 4

Risk	Probability of risk occurring	
Allergic reaction	0.9%	0.09
Hepatitis B infection	1 in (3×10^5)	0.000003
Hepatitis C infection	6.7×10^{-7}	0.00000067
Kidney damage	1 in 70 000	0.000014

Which risk has the **lowest** probability of occurring?

[1 mark]

Tick (✓) **one** box.

- Allergic reaction ☐
- Hepatitis B infection ☐
- Hepatitis C infection ☑
- Kidney damage ☐

Do not write outside the box

0 7 . 7 A person has a tumour blocking the tube leading from the gall bladder to the small intestine.

Explain why this person would have difficulty digesting fat.

[5 marks]

The gall bladder produces bile, that is secreted to the small intestine. The tumour is blocking or restricting the flow of bile into the small intestine. Bile is important to emulsify large fat droplets into smaller ones, to increase their surface area. This helps lipases break down fats effectively.
Bile also neutralises stomach acid, without it small intestine remains acidic creating unfavourable conditions for lipases to best break down fats.

19

END OF QUESTIONS