



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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Candidate signature

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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.

## 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
<b>TOTAL</b>	



JUN2184611H01

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

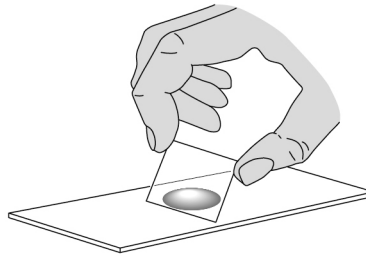
Do not write  
outside the  
box

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.

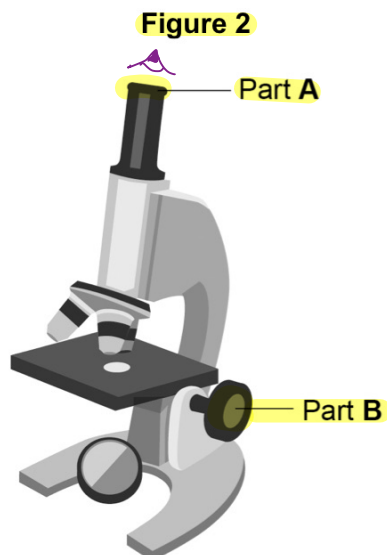
**[2 marks]**

- 1 microscope slide dye/stain (mounted) needle
- 2 cover slip pipette scalpel forceps / tweezers



Figure 2 shows the student's light microscope.

Figure 2 shows the student's light microscope.



0 1 . 2

Name part A.

[1 mark]

eyepiece / lens

0 1 . 3

What is the function of part B?

[1 mark]

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]

No cells in the field of view      Slide not in correct position

Mirror not in correct position      Objective lens dirty / not clicked into place

Student is looking at an air bubble      Microscope not focussed

Turn over ►



0 1 . 5

Red blood cells are specialised animal cells.

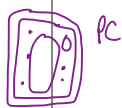
- Scientifically relevant features

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

- Magnitude of similarity

[6 marks]

Differences:



structural  
structural  
relevance to question

Red blood cell (RBC) has no nucleus, <sup>→ can contain more haemoglobin</sup> whereas plant cell (PC) does. RBC has no cell wall <sup>→ support</sup> whereas PC does. RBC has biconcave disc shape, <sup>→ to fit through narrow capillaries</sup> whereas plant cells have many shapes.

RBC contains haemoglobin whereas PC does not. PC contain chlorophyll, which RBCs do not contain. RBC has no chloroplasts or permanent vacuole, which PCs do have. RBCs much smaller than PCs

similarities: Both have cytoplasm. Both have cell membrane. Both contain pigments (although they are different).

• Have a balanced argument; won't get full marks for six differences

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]

Water enters the cells by osmosis <sup>→ movement of water across partially permeable membrane from dilute to concentrated solution</sup>  
 Plant cell has cell wall which prevents <sup>→ diffusion</sup> it from bursting

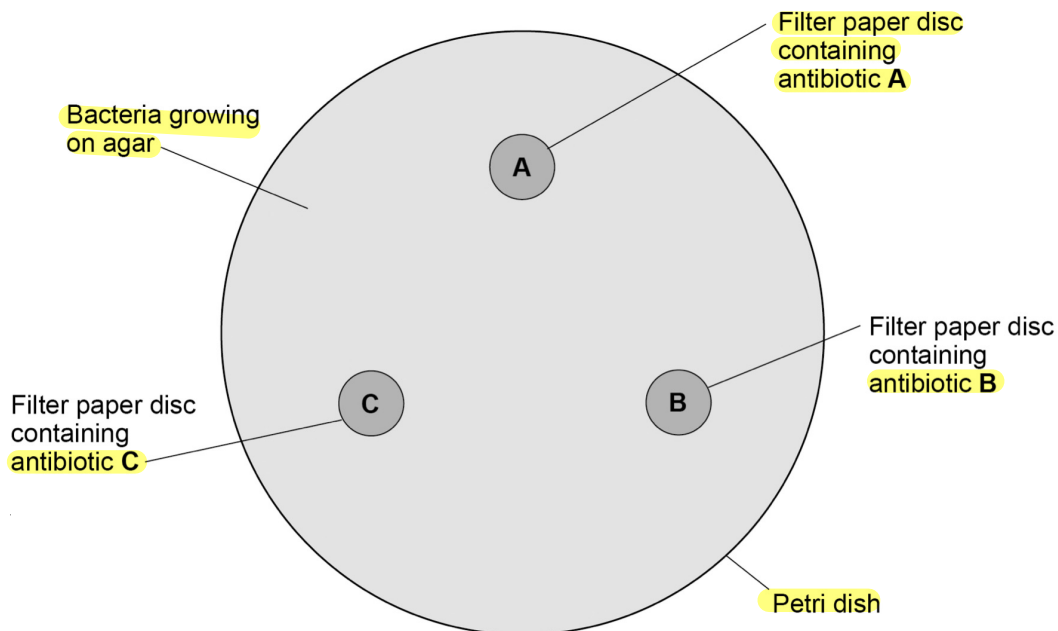


0 2

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. *ensures microorganisms being investigated don't escape or become contaminated*

0 2 . 1

Describe two aseptic techniques the student should have used.

[2 marks]

- 1 sterilising equipment / surfaces before use  
*secure lid of petri dish with tape*  
*only lift lid of petri dish a little*
- 2 use sterilised agar

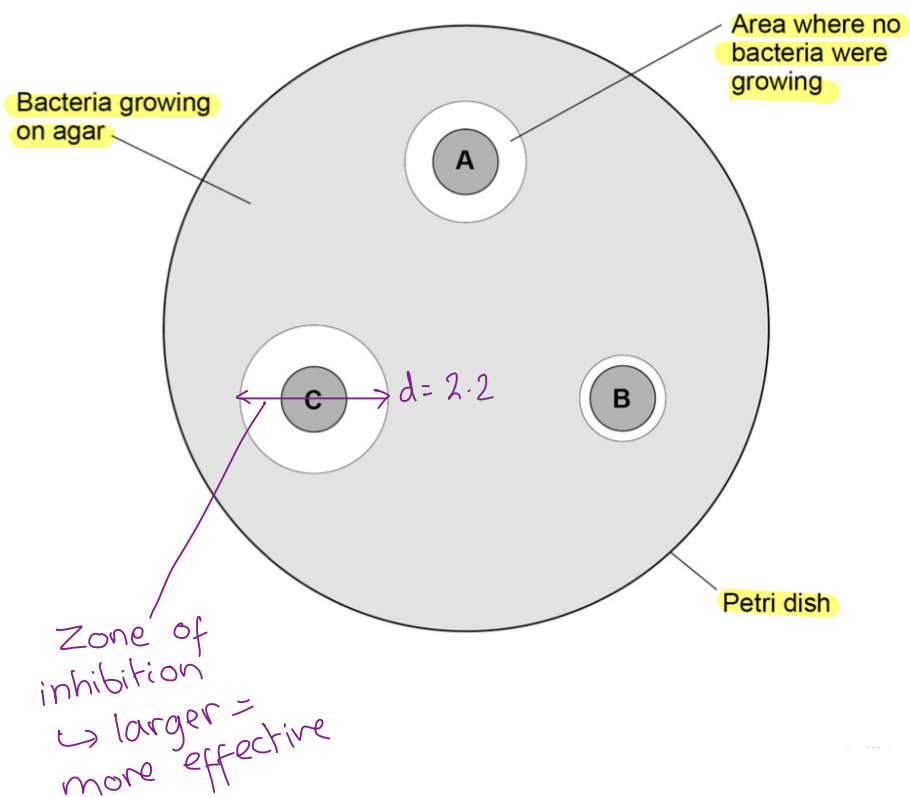
Turn over ►



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.

*smallest Z of I*

[1 mark]

Least effective antibiotic     B    

Reason     Kills fewest bacteria / has smallest area where no  
    bacteria growing    



0 2 . 3

Calculate the area where no bacteria were growing for antibiotic C.

Use  $\pi = 3.14$  . Measure diameter (cross section)

. Use

$$A = \pi \left( \frac{d}{2} \right)^2$$

$\rightarrow = r$

Give the unit.

[5 marks]

$d = 2.2$  cm unit

$$\frac{2.2}{2} = r$$

$$\text{Area} = 3.14 \times \left( \frac{2.2}{2} \right)^2$$

$$\text{Area} = 3.799...$$

$\rightarrow 1.1$

$$3.80 \text{ cm}^2$$

Area = 3.80 Unit cm<sup>2</sup>

0 2 . 4

Suggest one way the student could improve the investigation.

[1 mark]

Repeat and calculate the mean

Use a control disc

Repeat and eliminate anomalies

Use different types of bacteria



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.

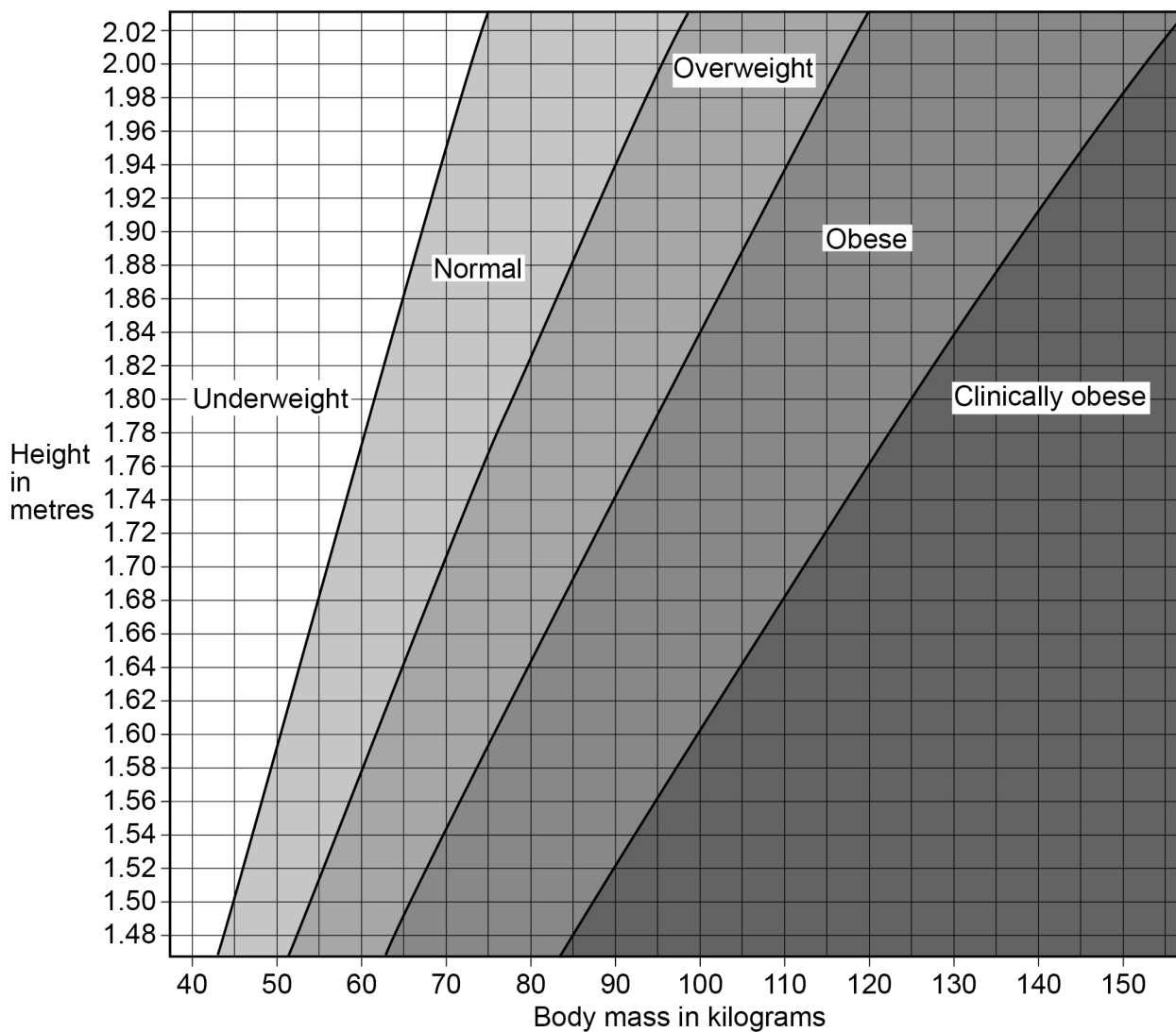
Table 1 shows information about two people.

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

Table 1

Person	Body mass in kg	Height in m	BMI in kg/m <sup>2</sup>
A	63	1.65	23.1
B	92	1.71 <sup>2</sup>	X

Figure 5 shows five BMI categories for adults.





0 3 . 1

Which is the BMI category of person A in Table 1?

[1 mark]

Tick (✓) one box.

Clinically obese

Normal

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]

$$\frac{92}{1.77^2} = 31.46\dots$$

$$31.5$$

$$x = 31.5 \text{ kg/m}^2$$

Question 3 continues on the next page

Turn over ►



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

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

[2 marks]

1 The higher the BMI, the lower the number of years living in good health

• The higher the BMI, the lower the total life expectancy

2 The higher the BMI, the higher the number of years living in bad health

0 3 . 3



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]**

Costs NHS / health service / Government / hospitals more money because they have to pay for additional surgery / medication / hospital stay to treat stroke / diabetes

More time off work (if unwell), so employer / Government have to give financial support

- 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]**

Movement issues                      loss of job/income

mental health impact from lack of movement / from pain

Need to visit doctor / take medication regularly

May need surgery

- 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 CVD / CHD (heart disease/attack, stroke)  
cardiovascular disease      coronary heart disease
- 2 Type 2 diabetes

(allows cancer, liver disease, high blood pressure / cholesterol)



0 4

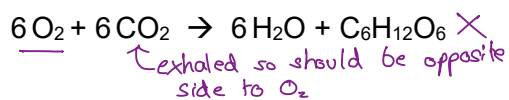
All living organisms **respire**.

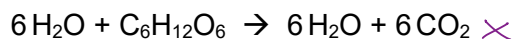
0 4 . 1

What is the **chemical equation** for **aerobic respiration**?

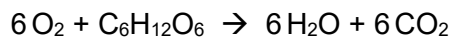
[1 mark]

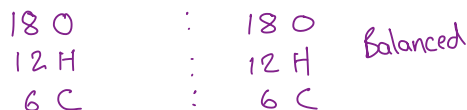
Tick (✓) **one** box.











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 movement / muscle contraction active transport

2 Keeping warm building larger molecules



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 produces lactic acid whereas aerobic does not  
 Aerobic produces water and anaerobic does not
- 2 Aerobic produces carbon dioxide whereas anaerobic does not  
 Anaerobic releases less energy than aerobic

0 4 . 5

What are the **two** products of **anaerobic respiration** in plant cells? → no O<sub>2</sub> consumed

[2 marks]

Tick (✓) **two** boxes.

- |  |                                     |
|--|-------------------------------------|
| Carbon dioxide ✓   | <input checked="" type="checkbox"/> |
| Ethanol ✓ <span style="margin-left: 20px;">Fermentation</span>     | <input checked="" type="checkbox"/> |
| Glucose  | <input type="checkbox"/>            |
| Lactic acid <span style="margin-left: 20px;">(animal cells)</span> | <input type="checkbox"/>            |
| Water  | <input type="checkbox"/>            |

Question 4 continues on the next page

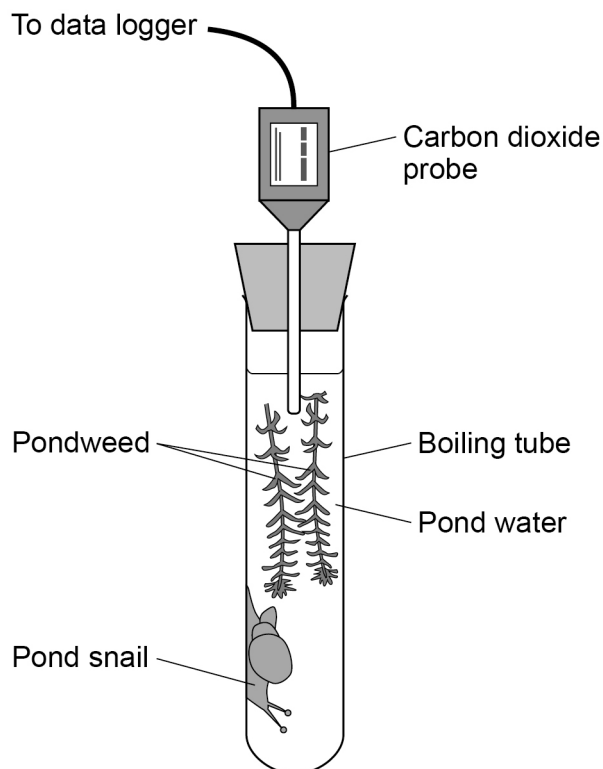
Turn over ►



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.

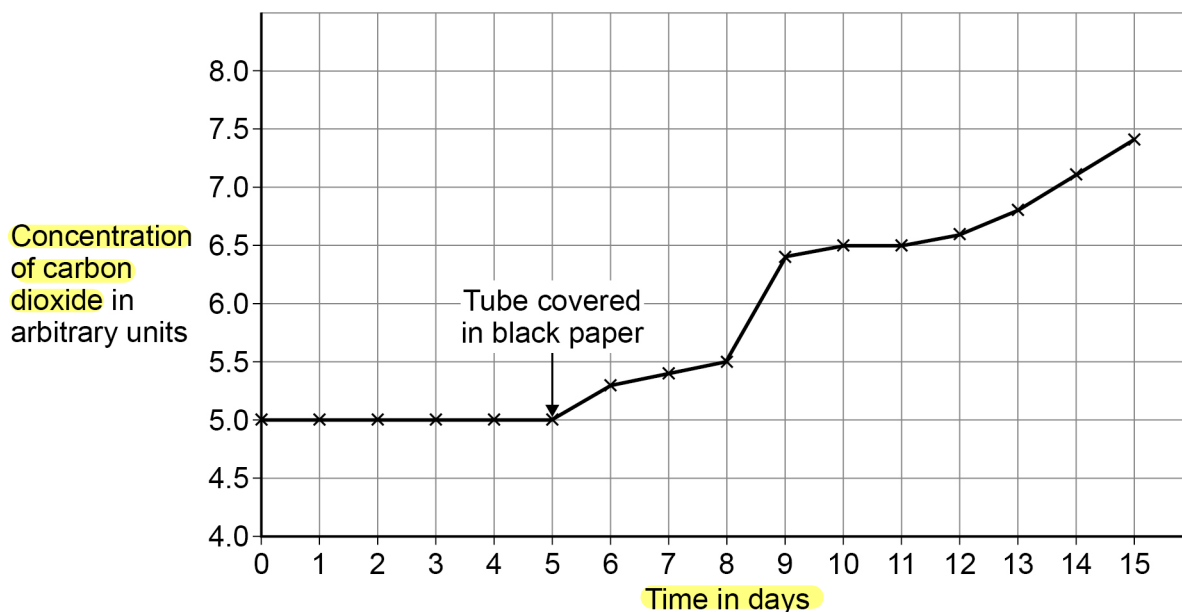
After 5 days, the scientist completely covered the boiling tube with black paper.

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



**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]**

Pondweed takes in  $CO_2$  for photosynthesis  
 Snail and pondweed respiring, producing  $CO_2$

**0 4 . 7** Suggest why the concentration of carbon dioxide increased between day 5 and day 10. **[1 mark]**

No light (so no photosynthesis) / plant not taking in  $CO_2$   
 Snail and plant respiring, releasing  $CO_2$

Question 4 continues on the next page

Turn over ►



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]**

Snail is being decomposed by decomposers/bacteria  
Decomposers respire, releasing  $\text{CO}_2$

---

14



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

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

[2 marks]

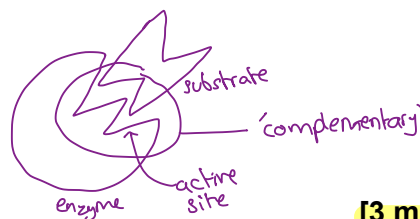
1 salivary gland

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]

Starch/substrate binds to active site of enzyme

Shape of enzyme active site and substrate are complementary

A chemical reaction occurs to produce smaller molecules

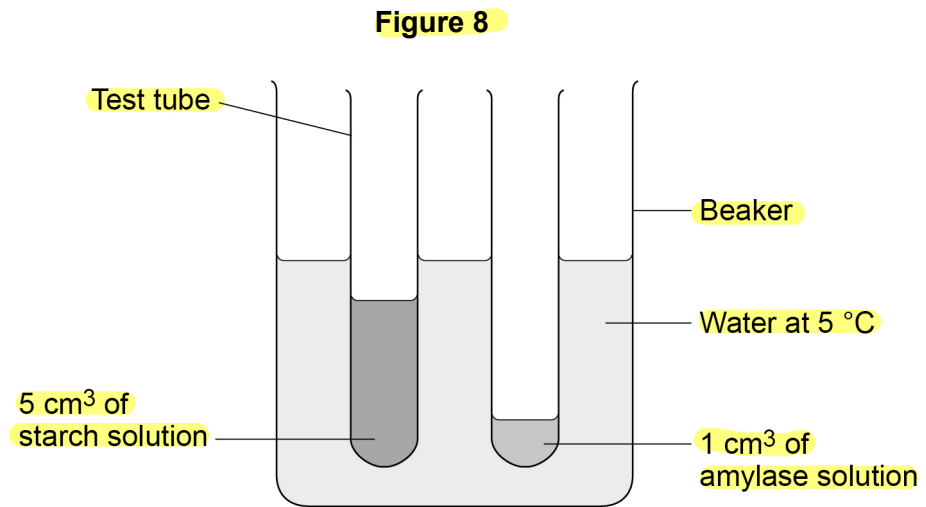
(or) bonds between starch molecules are broken to produce smaller molecules

Turn over ►



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

Figure 8 shows the apparatus used.



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 time before mixing solutions
- 2 volume of starch solution / amylase solution / mixture added to spotting tile / iodine added

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

[1 mark]

To allow the solutions to reach the same temperature as the water / allow both solutions to reach 5°C

Turn over ►



**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]

As temperature increases, enzyme activity increases until 35°C reached, after which activity decreases



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

Use **Table 3.**

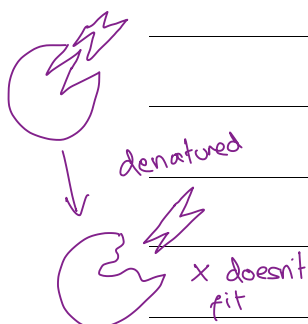
has not been broken down  
↑

**[5 marks]**

Iodine not yellow-brown because starch still present.

At 5°C amylase/starch molecules have low kinetic energy. There are fewer enzyme-substrate collisions.

At 80°C the amylase has been denatured  
starch can no longer fit



**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]**

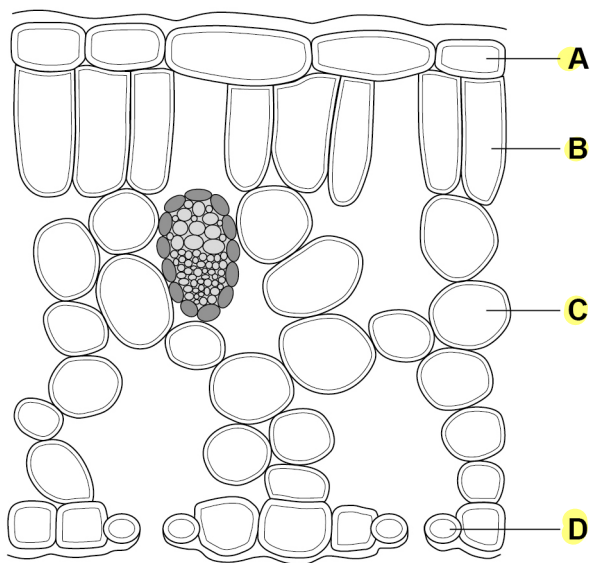
Keep temperature constant, but change enzyme concentration  
/ substrate concentration



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

0 6 . 2

Which cell structure in a leaf mesophyll cell is not found in a root hair cell?

[1 mark]

chloroplasts

*underground*  
*no light to absorb*



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

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

Increased light intensity *x increase water loss*

Increased density of stomata *x increase (more 'holes')*

Increased temperature *x increase water loss*

*evaporation*  
*difference in humidity*  
*temperature*  
*air flow*

Turn over ►



0 6 . 6

Compare the **structure** and **function** of **xylem tissue** and **phloem tissue**.**[6 marks]**Structure:

Xylem is made from dead cells, while phloem is made of living cells

Phloem cells have pores in their end walls, while xylem do not have pores in end walls

Xylem is hollow, while phloem contains cytoplasm. Xylem contains lignin but phloem does not contain lignin. Both are tubular. Both made of cells.

Function:

Xylem transports mineral ions/water while phloem transports dissolved sugars

Xylem is involved in transpiration while phloem is involved in translocation

Xylem transports unidirectionally, phloem transports bidirectionally

Both transport liquids/substances through stem/leaves/roots/plant

- Identify scientifically relevant features ✓
- State how they are similar/different ✓
- Magnitude of similarity/difference ✓

- Reference structure, function, similarity and difference





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ANSWER IN THE SPACES PROVIDED**

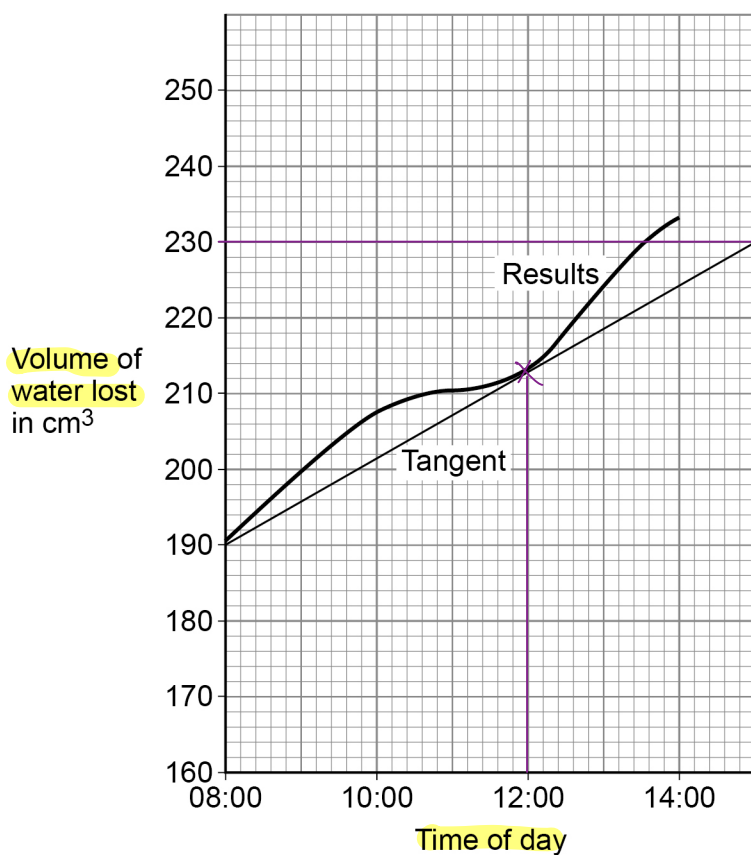
**Turn over ►**



2 5

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  $\text{cm}^3$  per minute
- in standard form.

$$\text{Rate of change} = \frac{\Delta y}{\Delta x}$$

$$\Delta y = 230 - 190$$

$$\Delta x = 15 - 8$$

[4 marks]

$$x \times 10^y$$

$$1 \leq x < 10$$

← In hours

$$\hookrightarrow = 7 \text{ hours}$$

$$\text{Rate of change} = \frac{40}{420} = 0.09523... \text{ cm}^3 \text{ min}^{-1}$$

$$7 \times 60 = 420$$

$$230 - 190 = 40$$

$$\hookrightarrow 9.523... \times 10^{-2}$$

$$\text{Rate of water loss} = 9.5 \times 10^{-2} \text{ cm}^3 \text{ per minute}$$

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

Explain why.

[2 marks]

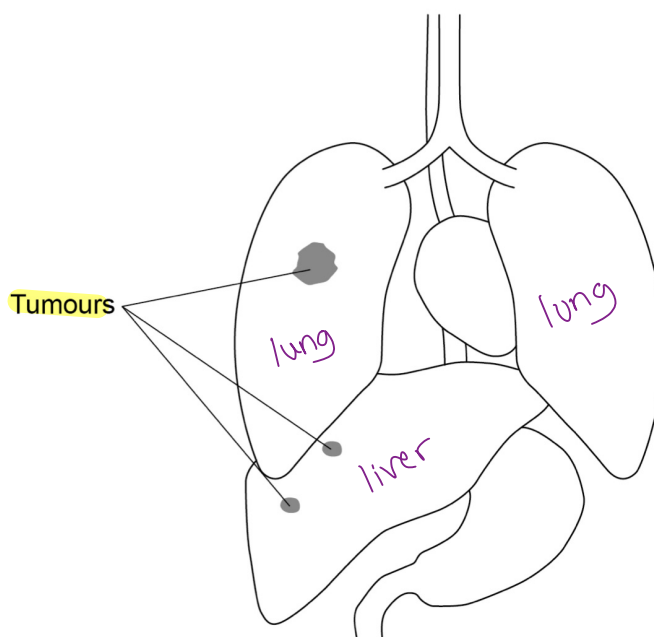
Stomata almost completely closed because it is cooler/  
because there is less light



0 7

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

**Figure 11**



**Malignant tumours** are **cancers**.

**Describe** what happens to **cells** when a **tumour forms**.

**[1 mark]**

Cells grow / divide abnormally / uncontrollably

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

**[1 mark]**

Has spread to other parts / organs of the  
body



07.3

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.

- Relevant points identified
- Detail
- Logically linked

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

[6 marks]

Tiredness:

fewer red blood cells (RBC), so less haemoglobin, so less  $O_2$  transported around body. Less aerobic respiration, so less energy released. Lactic acid produced causes muscle fatigue.

Infections:

fewer white blood cells (WBC) so fewer antibodies produced / less phagocytosis. fewer pathogens therefore killed.

phagocytes / lymphocytes

Bleeding:

fewer platelets so blood does not clot as easily

cell fragments → 'sticky'

Must refer to all three symptoms for full marks

Turn over ►



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

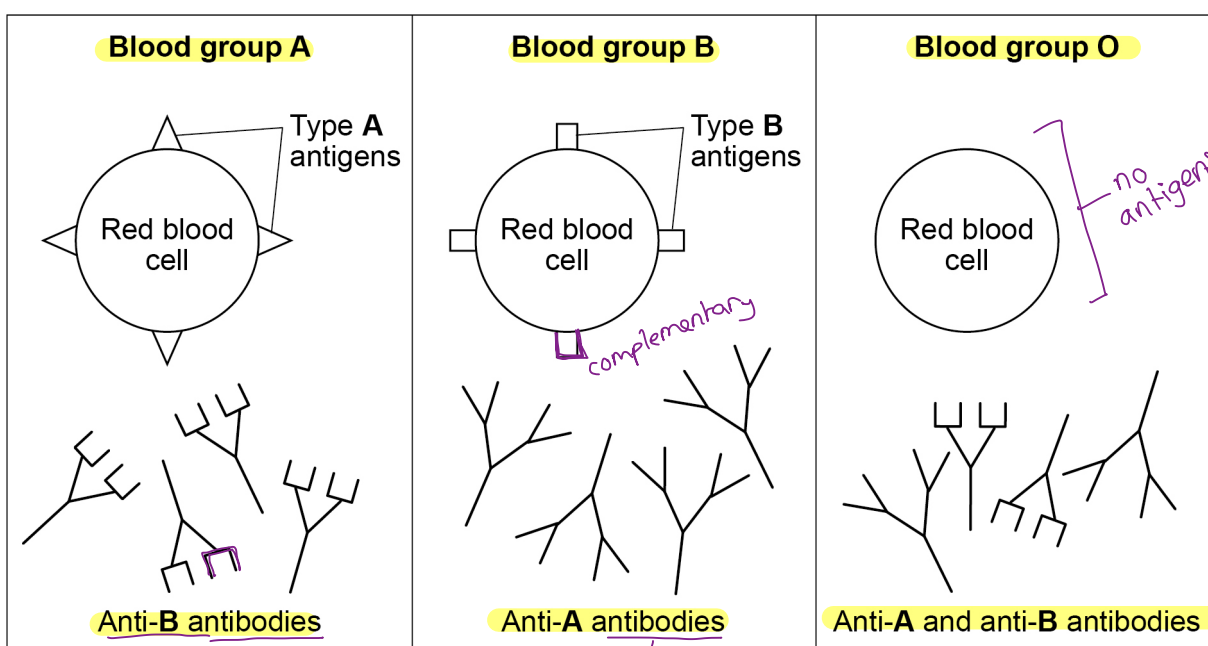
A **blood transfusion** is where a patient **receives blood from a donor**.

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  $\mu\text{m}$**  in diameter.

Many **capillaries** have an **internal diameter of about 10  $\mu\text{m}$** .



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]

Anti-B antibodies will bind to type B antigens on donor's red blood cells.

So red blood cells clump together and are wider than capillaries / block capillaries

Cells therefore have reduced amount of oxygen / glucose

(or cells cannot respire)

0 7 . 5

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

[2 marks]

No antigens on type O RBC, so antibodies cannot bind to the antigens / RBCs

Turn over ►



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0 7 . 6

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

**Table 4**

<b>Risk</b>	<b>Probability of risk occurring</b>
Allergic reaction	0.9%
Hepatitis B infection	1 in $(3 \times 10^5)$ $\frac{1}{3 \times 10^5} \times 100 = 3.33... \times 10^{-4} \%$
Hepatitis C infection	$6.7 \times 10^{-7}$ $\times 100 = 6.7 \times 10^{-5}$ <small>smallest</small>
Kidney damage	1 in 70 000 $\frac{1}{70\,000} \times 100 = 1.428... \times 10^{-3}$

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

**[1 mark]**

Tick (✓) **one** box.

Allergic reaction

Hepatitis B infection

Hepatitis C infection

Kidney damage





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]**

No/ less bile reaches the small intestine ✓  
So less emulsification of fat ✓  
So smaller surface area for lipase to break down fat ✓  
pH of small intestine is not neutralised / is alkaline ✓  
So lipase is not at its optimum pH to break down fat ✓



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ANSWER IN THE SPACES PROVIDED**





