AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
BIOLOGY

H

Higher Tier Paper 1H

Tuesday 14 May 2019 Afternoon 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.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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	
8	
TOTAL	

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

Do not write outside the box

0 1 **Figure 1** shows an animal cell viewed using a microscope.

Figure 1

0 1 . 1 The cell contains a nucleus.

What is the function of the nucleus?

[1 mark]

controls the activities of the cell ✓ contains genetic material ✓

0 1 . 2 Name **one** type of cell that does **not** contain a nucleus.

[1 mark]

red blood cell — because the space is needed for haemoglobin

bacteria / prokaryote — have genetic material free in the cytoplasm (not membrane bound)

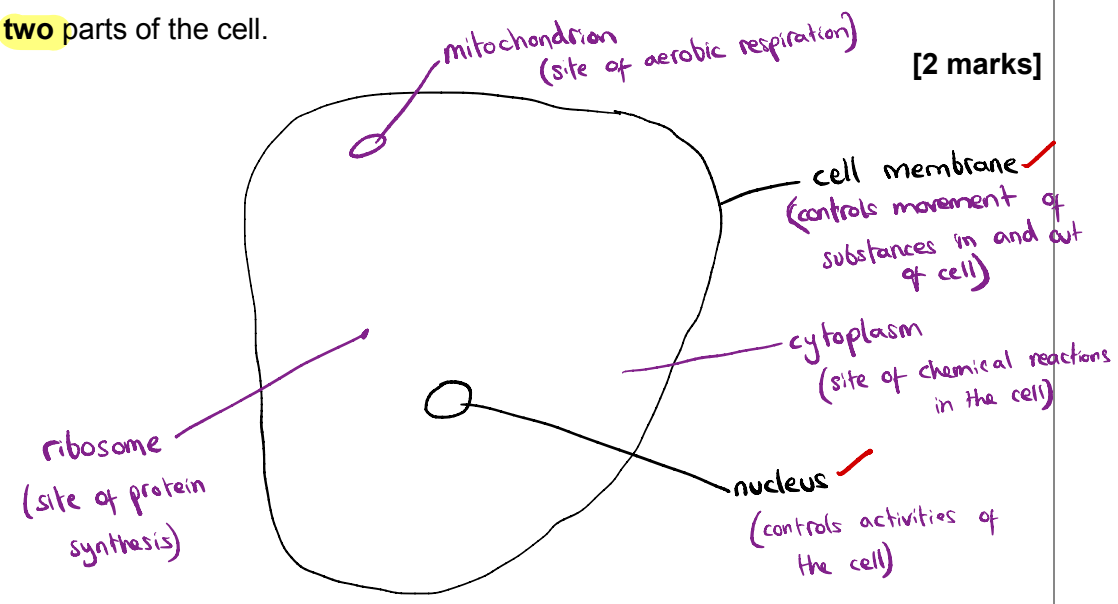
xylem cells — dead cells that don't need a nucleus to carry out any functions

Do not write outside the box

0 1 . 3 Draw a simple diagram of the cell in **Figure 1**.

Label **two** parts of the cell.

[2 marks]



0 1 . 4 Name **one** structure found in a plant cell but **not** found in an animal cell.

[1 mark]

cellulose cell wall / chloroplast / (permanent) vacuole

Question 1 continues on the next page

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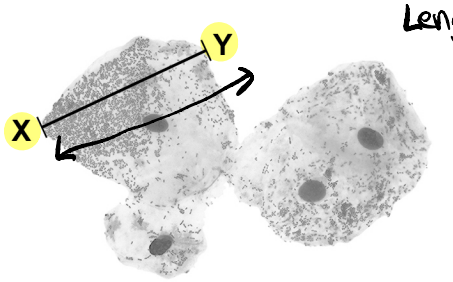
Figure 2 shows some different cells.

Figure 2



Length $\overrightarrow{XY}$ = 24mm

The real length from point **X** to point **Y** is 0.06 mm

Calculate the magnification.

Use the equation:

$$\text{magnification} = \frac{\text{size of image}}{\text{real size of object}}$$

[3 marks]

Size of image = 24 mm ✓

Real size = 0.06 mm

$\frac{24}{0.06}$ ✓ = magnification

$\frac{24}{0.06} = 400$

Magnification = × 400 ✓

Do not write outside the box

0 1 . 6 The cells shown in **Figure 2** were viewed using a light microscope.

Give **two** advantages of using an electron microscope instead of a light microscope. **[2 marks]**

↳ uses a beam of accelerated electrons
↳ electrons have a shorter wavelength than light
↳ has a higher resolving power and higher magnification

1 higher magnification

2 higher resolution / resolving power

(allows '3D image')
↳ microscope detects the electrons that reflect back off of the specimen

10

Do not write outside the box

Mosquitoes carry a pathogen that causes malaria.

What type of pathogen causes malaria?

[1 mark]

Tick (✓) **one** box.

A bacterium ☐

A fungus ☐

A protist ☑ (The Plasmodium protist)

A virus ☐

Mosquito nets can help prevent the spread of malaria.

Table 1 shows the results of a study in one area of Africa.

Table 1

Total number of people in the study	Number of people who use mosquito nets when sleeping	Percentage of people with malaria	
		Who use mosquito nets when sleeping	Who do NOT use mosquito nets when sleeping
476	426	1.2	40

1.2 < 40

A newspaper made the following statement:

'Study shows mosquito nets are scientifically proven to prevent malaria.'

Give **one** piece of evidence that supports the statement.

[1 mark]

lower percentage of people with malaria when using mosquito nets

Do not write outside the box

0 2 . 3 Suggest **one** reason why the statement may **not** be valid.

[1 mark]

Some people who use mosquito nets have malaria

Data is from only one area

No other information about the people is considered

Group sizes is too small

Table 2 shows information about the number of deaths from malaria in the same area of Africa.

Table 2

Year	Number of deaths from malaria per 100 000 people
2005	161
2007	136
2009	114
2011	97
2013	94
2015	92

-3

-2

Eg. ↓
Predict another
-2
92-2=90

0 2 . 4 Predict the number of people per 100 000 who died from malaria in 2017 if the trend stayed the same.

[1 mark]

MS allows any from 88–91

Number of people per 100 000 = 90

0 2 . 5 Use of mosquito nets has helped to reduce the number of deaths from malaria each year.

Suggest **one** other reason for the reduced number of deaths from malaria each year.

[1 mark]

Improved healthcare

Use of mosquito control methods

changing behaviour to avoid being bitten

Do not write outside the box

0 2 . 6 Describe how the human body:

- prevents pathogens from entering
- defends itself against pathogens inside the body.

Logical order
Well explained points
Include both bullet points given

[6 marks]

(Prevention of entering)

- Skin acts as a barrier ✓, 'oil' ('sebum') on the surface that repels pathogens ✓ scabs form over cuts / scabs form a barrier ✓
- Eyes produce tears ✓, tears are antiseptic ✓, contain enzymes to kill bacteria ✓
- (Breathing system) Trachea / nose / bronchi contain mucus ✓ which is sticky and traps bacteria ✓. Mucus is carried away by cilia ✓ (small hairs lining air passages)

(Defends against pathogens inside body)

- White blood cells / immune system ✓
- Antitoxins are produced ✓ and neutralise toxins produced by pathogen
- Antibodies produced ✓ and help destroy pathogens ✓
- Memory cells form ✓ and trigger more rapid response if pathogen re-enters ✓

11

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 3 This question is about photosynthesis.

0 3 . 1 Complete the word equation for photosynthesis:

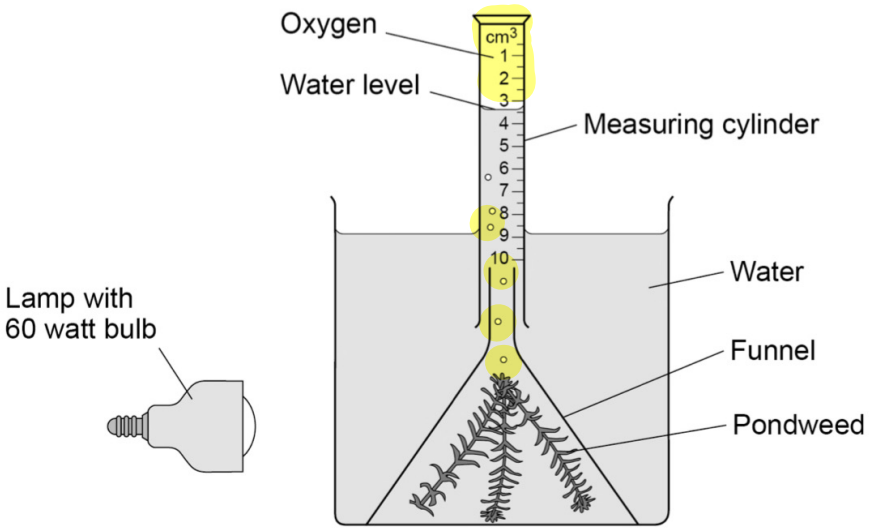
[2 marks]

carbon dioxide + water → glucose + oxygen

A student investigated photosynthesis using pondweed.

Figure 3 shows the apparatus the student used.

Figure 3



This is the method used.

1. Set up the apparatus as shown in **Figure 3**.
2. Switch on the lamp.
3. After 20 minutes, record the volume of oxygen collected in the measuring cylinder.
4. Repeat steps 1–3 using bulbs of different power output.

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0 3 . 2 What was the independent variable in the investigation?

→ the variable you change

[1 mark]

Tick (✓) **one** box.

- Power output of bulb ✓
- Rate of photosynthesis
- Time to collect oxygen
- Volume of oxygen collected

Suggest **two** ways the method could be improved so the results would be more valid.

[2 marks]

1 Do repeats and calculate the mean

2 Control the water temperature

- Control the distance between the bulb and pondweed
- Control the mass/length/species/age of the pondweed
- Give pondweed time to equilibrate → get used to the conditions

Do not write outside the box

Table 3 shows the student's results.

Table 3

Power output of bulb in watts	Volume of oxygen collected in 20 minutes in cm^3	Rate of photosynthesis in cm^3/hour
60	0.5	1.5
100	0.8	2.4
150	1.1	X= 3.3
200	1.2	3.6
250	1.2	3.6

0 3 . 4 Calculate value **X** in **Table 3**.

[1 mark]

1.1 cm^3 = 20 mins of photosynthesis 60 ÷ 20 = 3

1.1 x 3 = 3.3 3.3 cm^3 = 60 mins of photosynthesis

X = 3.3 cm^3/hour

Do not write outside the box

0 3 . 5 Complete **Figure 4**.

[4 marks]

You should:

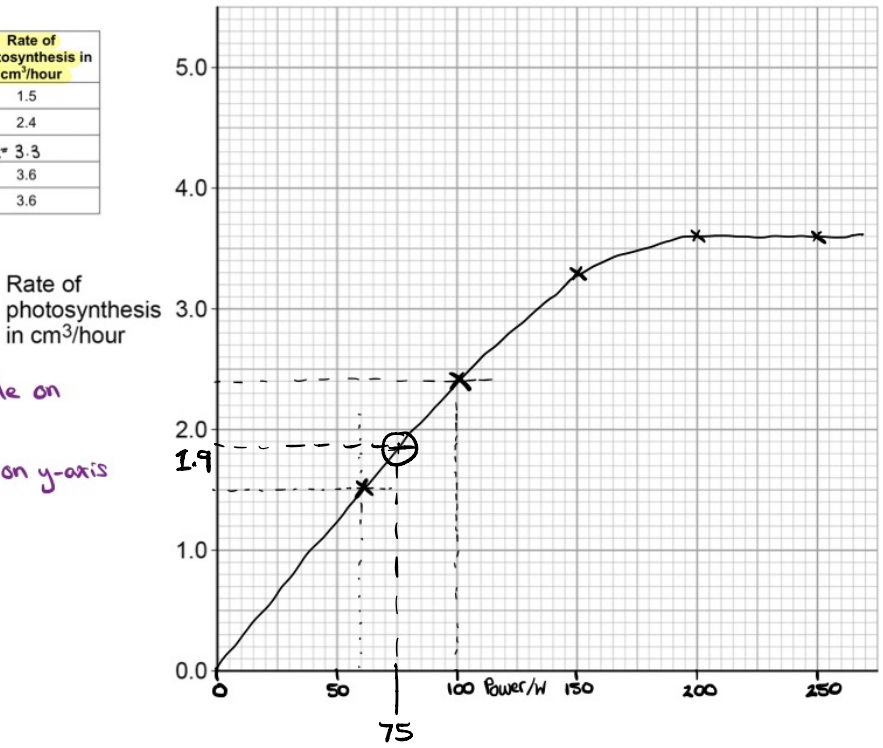
- label the x-axis
- use a suitable scale
- plot the data from **Table 3** and your answer to Question **03.4**
- draw a line of best fit.

Table 3

Power output of bulb in watts	Volume of oxygen collected in 20 minutes in cm^3	Rate of photosynthesis in cm^3/hour
60	0.5	1.5
100	0.8	2.4
150	1.1	X = 3.3
200	1.2	3.6
250	1.2	3.6

- Independent variable on x-axis
- Dependent variable on y-axis

Figure 4



Determine the expected rate of photosynthesis with a bulb of power output 75 watts.

Use **Figure 4**.

[1 mark]

(MS allows 1.8 / 1.9)

Rate of photosynthesis at 75 watts = 1.9 cm^3/hour

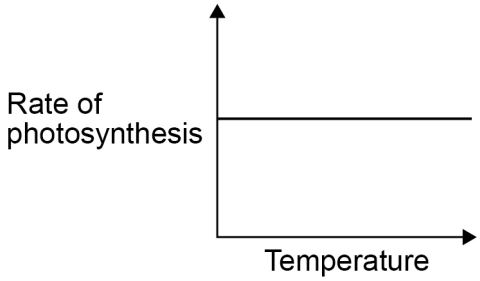
Turn over ►

Do not write outside the box

0 3 . 7 Which graph shows the effect of temperature on the rate of photosynthesis?

[1 mark]

Tick (✓) **one** box.



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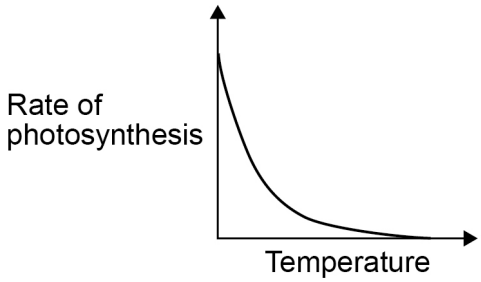

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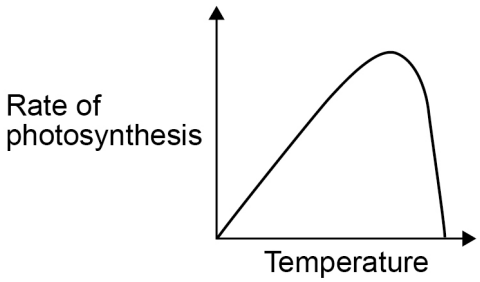

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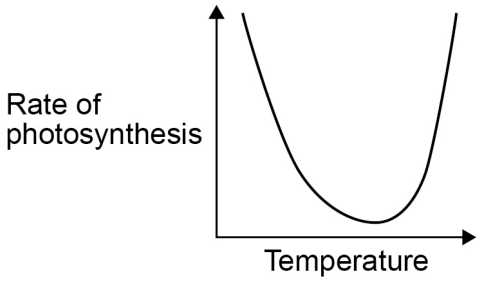

☐

As temperature increases the rate of photosynthesis increases until the temperature is so high that it is damaging to the plant

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Do not write outside the box

0 4 Water moves from a plant to the atmosphere through the leaves.

0 4 . 1 How is the volume of water lost from the leaves controlled?

[1 mark]

(by the guard cells) opening and closing the stomata

→ holes on underside of the leaf

0 4 . 2 Describe the transport of water through a plant from the roots to the atmosphere.

[3 marks]

- Water is transported in xylem ✓
- Water evaporates ✓ from leaves...
- ... through the stomata ✓

→ MS accepts 'between guard cells'

Turn over ►

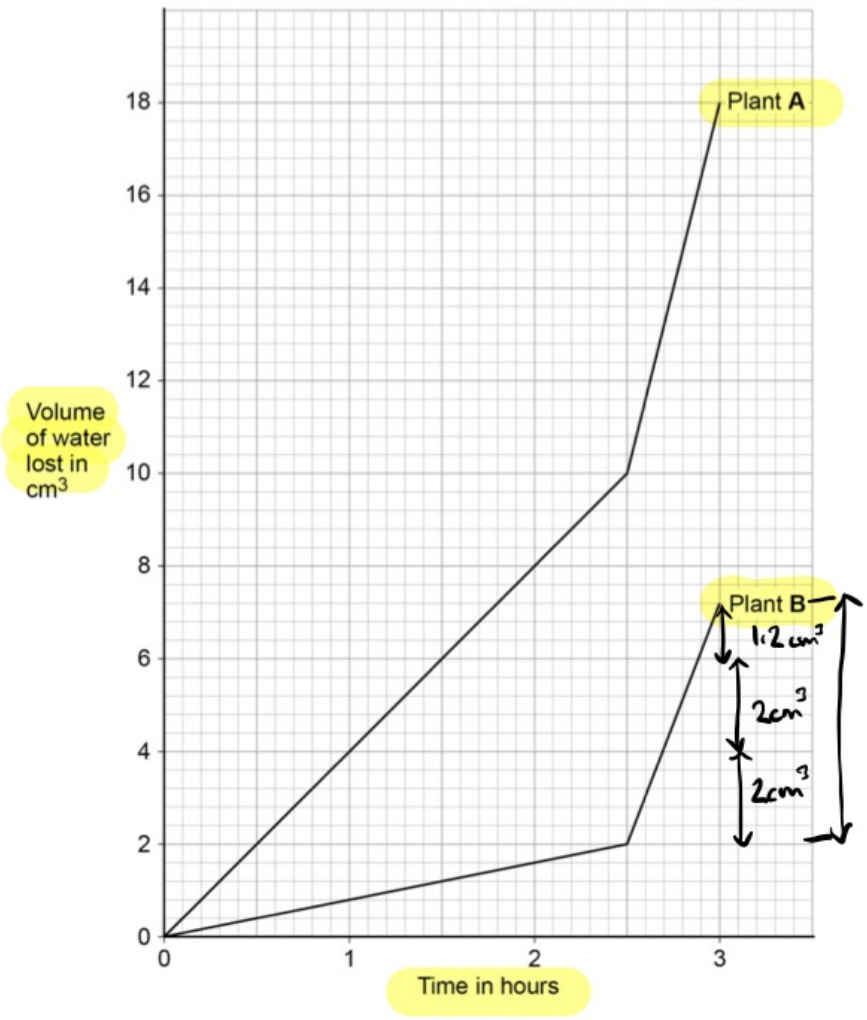
Do not write outside the box

A student investigated the volume of water lost from two plants of different species.

Both plants were kept together.

Figure 5 shows the student's results.

Figure 5



Do not write outside the box

0 4 . 3 Suggest **one** reason for the difference in the rate of water loss from the two plants in the first 2.5 hours.

[1 mark]

- Plant A has more stomata → holes through which water loss can occur
- Plant A has more leaves → increases surface area
- Plant A has bigger leaves

Both plants were moved to a different place at 2.5 hours.

0 4 . 4 Calculate the rate of water loss per hour in plant **B** from 2.5 hours to 3 hours.

Give your answer to **2** significant figures.

[3 marks]

Water loss = 5.2 cm^3 ✓

Rate of change = $\frac{5.2}{\text{time}} = \frac{5.2}{3-2.5} = \frac{5.2}{0.5}$ ✓

$= 10.4$ (3 s.f)

Rate of water loss = 10 ✓ (2 s.f) cm^3/hour

Suggest **two** reasons why the rate of water loss in both plants changed after 2.5 hours.

[2 marks]

1 it was warmer — it was less humid

2 Light intensity was higher — it was windier

10

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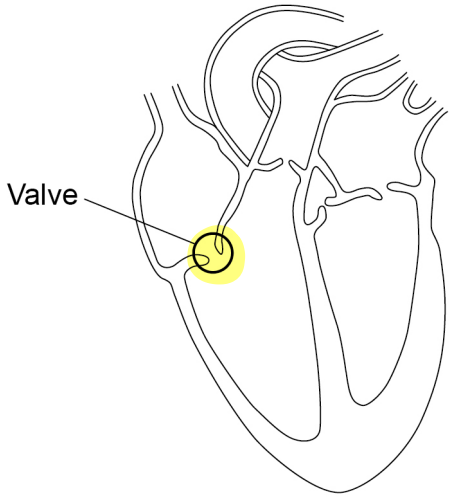
0 5 **Figure 6** shows the internal structure of the human heart.

One of the heart valves is labelled.

Figure 6



Sometimes a valve in the heart can start to leak.

- Identify relevant points
- Explain with logical order

Explain why a person with a leaking heart valve has difficulty exercising.

[4 marks]

- Backflow can occur, meaning less blood is pumped around the body
- Less O_2 supplied to muscles, so less aerobic (with O_2) respiration occurs
- Less energy is released, so less efficient muscle contraction
- Anaerobic respiration occurs, causing oxygen debt (shortage of O_2 in body tissues) and the buildup of lactic acid
- Buildup of lactic acid causes muscle fatigue
- Less efficient removal of carbon dioxide

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Question 5 continues on the next page

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ANSWER IN THE SPACES PROVIDED

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A patient with a leaking heart valve may have the valve replaced.

A study compared two different types of replacement heart valve:

- mechanical valves
- biological valves from pigs.

The data used in the study was collected from female patients aged 50–69.

Table 4 shows the data.

Table 4

	Type of replacement heart valve	
	Mechanical	**Biological**
Number of patients given the valve	2852	1754
Number of patients who died from heart-related problems after valve replacement	180	178
Percentage of patients alive after 5 years	91	89
Percentage of patients needing a second valve replacement within 6 years	2.2	5.2
Percentage of patients who had a blood clot on the brain after surgery	5.8	0.1

0 5 . 2 Give **one** conclusion about the death of patients from heart-related problems after a valve replacement.

Include calculations to support your answer.

[3 marks]

Table 4

	Type of replacement heart valve	
	Mechanical	Biological
Number of patients given the valve	2852	1754
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Percentage of patients who had a blood clot on the brain after surgery	5.8	0.1

% Patients who died after mechanical valve: $\frac{180}{2852} \times 100 = 6.31136 \approx 6\%$ ✓

% Patients who died after biological valve: $\frac{178}{1754} \times 100 = 10.14823 \approx 10\%$ ✓

Higher percentage of those with the biological valve died in comparison to those with the mechanical valve ✓

Do not write outside the box

0 5 . 3 One risk of mechanical valves is that blood clots can form on the surface of the valve.

Name the component of the blood that starts the process of blood clotting.

[1 mark]

platelets (thrombocytes)

0 5 . 4 Evaluate the use of mechanical replacement heart valves and biological replacement heart valves.

Use information from **Table 4** and your own knowledge.

[6 marks]

- Logically linked & relevant points
- Support using Table 4 and own knowledge
- Arrive at your own judgement

Mechanical
- Less likely to need replacement within 6 years (2.2% < 5.2%); they last longer
- Lower percentage deaths from heart problems
- However, blood clots on brain more likely (5.8% > 0.1%) and patient must take anti-clotting drugs for life
- This can cause excessive bleeding

Biological
- Additional medication not required
- However valve comes from an animal, which may cause ethical concern
- Rejection is more likely
  ↳ Patient may need immuno suppressants

Judgement

eg. The biological valve is better because there is less clotting, which causes several life-threatning issues like heart attacks (etc). Blood thinners also not needed, so fatal bleed less likely

Table 4

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	Mechanical	Biological
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14

Do not write outside the box

0 6 People with diabetes have difficulty controlling their blood glucose concentration.

0 6 . 1 Which part of the blood transports glucose?

[1 mark]

Tick (✓) **one** box.

- Lymphocytes ☐ ← Immune response
- Plasma ☑
- Platelets ☐ ← clotting
- Red blood cells ☐ ← O_2

Glucose is often found in the urine of people with diabetes.

0 6 . 2 Name a chemical used to test for glucose.

[1 mark]

Benedict's solution

Describe a test that could be used to show that a person's urine contains glucose.

[2 marks]

Test Add Benedict's reagent to sample and heat/ boil

Positive result colour change from blue to brick red

Do not write outside the box

0 6 . 4 The body cells of a person with untreated diabetes lose more water than the body cells of a person who does **not** have diabetes.

Explain how diabetes can cause the body cells to lose more water.

[3 marks]

- The blood is more concentrated than the solution within body cells.
- Water thus moves out of cells by osmosis ...
- ... through a partially permeable membrane

0 6 Glucose is absorbed into the blood in the small intestine by both diffusion and active transport.

Describe how the small intestine is adapted for efficient absorption.

[5 marks]

projections

- Villi provide a large surface area for diffusion
- Walls of villi are thin for a short diffusion distance
- The small intestine is very long so there is more time for absorption to occur
- Good supply of blood to maintain steep concentration gradient
- Cells have many mitochondria for aerobic respiration, providing energy for active trasport

12

Do not write outside the box

0 7 A small animal called an axolotl lives in water. The axolotl has a double circulatory system.

0 7 . 1 Define the term double circulatory system.

[1 mark]

Blood is pumped to the lungs by one side of the heart and to the body by the other

Figure 7 shows the double circulatory system of the axolotl.

Figure 7

The following figure cannot be reproduced here due to third-party copyright restrictions.

0 7 . 2 The heart of the axolotl has only one ventricle.

Label the ventricle on **Figure 7**.

[1 mark]

[No solution due to redacted image]

Do not write outside the box

0 7 . 3 Explain why having only one ventricle makes the circulatory system less efficient than having two ventricles.

[2 marks]

- Oxygenated and deoxygenated blood mixes, so less oxygen reaches body cells/ tissues.

Figure 8 shows an axolotl.

Figure 8

0 7 . 4

[4 marks]

Explain why an axolotl may die in water with a low concentration of oxygen.

[4 marks]

- Concentration gradient of oxygen is shallower therefore less oxygen diffuses into the gills of the axolotl (and therefore its blood)

i.e the difference between concentration of O_2 in the water and in the axolotl is smaller

- Less aerobic respiration occurs, so less energy is released ...

- ... so less metabolism

→ no O_2

or → anaerobic respiration occurs and lactic acid is produced, which is toxic

Turn over ►

Do not write outside the box

If a gill of an axolotl is removed, a new gill will grow in its place.

Scientists hope to use information on how axolotls grow new gills to help with regenerating human tissue.

0 7 . 5 Name the type of cell that divides when a new gill grows.

[1 mark]

stem cells

0 7 . 6 Name **one** condition that could be treated using regenerated human tissue.

[1 mark]

paralysis - diabetes - Parkinson's - heart disease - cancer - cystic fibrosis - burns

0 7 . 7 Suggest **one** reason why an axolotl is a suitable animal for research in the laboratory.

[1 mark]

- Easy to breed - cheap to keep (they're small!) - don't take up much space

0 7 . 8 An axolotl may **not** be a suitable animal to study when researching regeneration in human tissue.

Suggest **one** reason why.

[1 mark]

- Not a mammal (/is an amphibian)
- Regeneration in gills may be different to that in other organs
- Metabolism/body processes are too different to those in humans

12

Do not write outside the box

0 8 Pancreatic cancer develops when a malignant tumour grows inside the pancreas.

0 8 . 1 The pancreas produces digestive enzymes.

What is an enzyme? **[2 marks]**

→ speeds up reactions without being used up

Chemical which catalyses reactions in living organisms

(Biological Catalyst)

Carbohydrase is an enzyme produced by the pancreas.

Name **two** other organs in the digestive system that produce carbohydrase. **[2 marks]**

1 Salivary gland (in the mouth → active when chewing)

2 Small intestine

0 8 . 3 One symptom of pancreatic cancer is weight loss.

Explain how pancreatic cancer may cause a person to lose weight.

Do **not** refer to hormones in your answer. **[4 marks]**

produces enzymes

- Reduced enzyme production from pancreas
- food is not fully digested and less glucose absorbed into the bloodstream
- less glucose available for respiration so more fat used up in metabolism (and/or) respiration
- fewer amino acids (→ make proteins) absorbed in the blood
- fewer amino acids for making protein for growth and repair
- fewer fatty acids absorbed, so less fat stored in the body

[- Chemotherapy causes nausea / loss of appetite]

Turn over ▶

Do not write outside the box

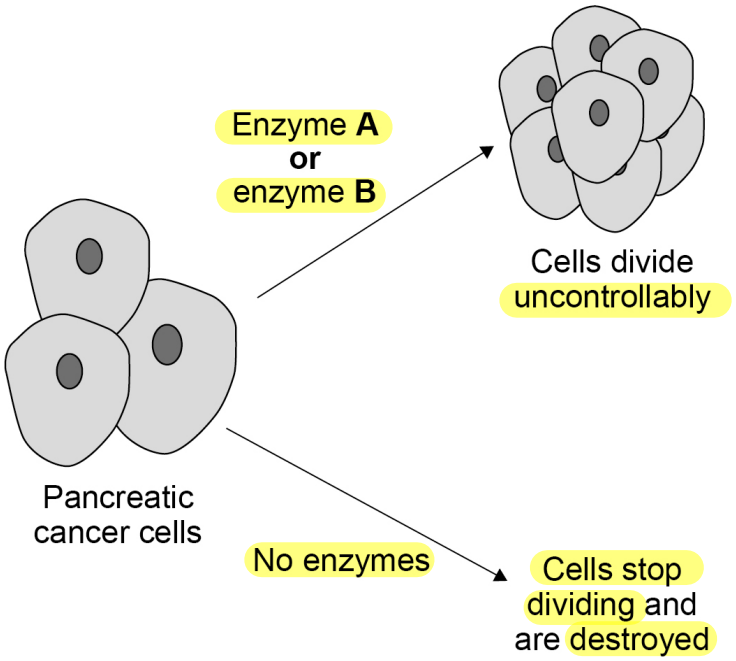
Enzyme **A** and enzyme **B** are involved in controlling cell division in pancreatic cancer cells.

Most cancer cells produce both enzyme **A** and enzyme **B**.

Some people have a gene mutation that stops cancer cells producing enzyme **B**.

Figure 9 shows how cell division is controlled in pancreatic cancer cells.

Figure 9



Do not write outside the box

Scientists have developed a drug that inhibits enzyme **A**.

The drug is given to pancreatic cancer patients who have the gene mutation that stops cancer cells producing enzyme **B**.

The drug only targets cancer cells.

0 8 . 4 Explain why the drug can be used to treat pancreatic cancer in patients with the gene mutation.

Use information from **Figure 9**.

[3 marks]

- Cancer cells cannot divide ...
- ... So the tumor does not form / grow larger
- Because both enzymes A and B are not working

* Also less likely to develop secondary tumors, meaning spread is less likely

Explain why the drug could **not** be used to treat pancreatic cancer in a patient that produces both enzyme **A** and enzyme **B**.

[2 marks]

- Enzyme B would still be made, therefore cells would still divide uncontrollably

Do not write outside the box

0 8 . 6 The drug was trialled before it was licensed for use.

To improve validity of the results in the trial:

validity → how accurately the experiment measures what it was intended to measure

- some patients were given a placebo
- a double-blind trial was used.

Give reasons why a placebo and a double-blind trial were used.

[2 marks]

A placebo, take into account psychological effect

→ 'Dummy' drug

→ 'Placebo effect' - patients given placebo believe their symptoms are improving because they think they have treatment

A double-blind trial, to avoid bias

→ Neither doctors nor patients know who has placebo and who has real drug

0 8 . 7 One stage in a drug trial is to test the drug on healthy volunteers.

What is the next stage in the drug trial?

[1 mark]

Tick (✓) **one** box.

- Testing on all patients with the disease ☐
- Testing on human tissue ☐
- Testing on live animals ☐
- Testing on volunteers with the disease ☑

Do not write outside the box

0 8 . 8 A monoclonal antibody has been produced to treat pancreatic cancer.

→ Identical copies of one type of antibody

Explain how the monoclonal antibody works to treat pancreatic cancer.

[3 marks]

- Monoclonal antibody is attached to radioactive substance

→ toxin/drug/chemical → whatever is being used to kill tumour

- Monoclonal antibody will only attach to cancerous cells / tumour

- Radioactive substance will bind to cancer cells and stop them from dividing

↳ Monoclonal antibody interrupts cell cycle

↳ Action of monoclonal antibodies helps immune system destroy cancer cells

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ANSWER IN THE SPACES PROVIDED