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.

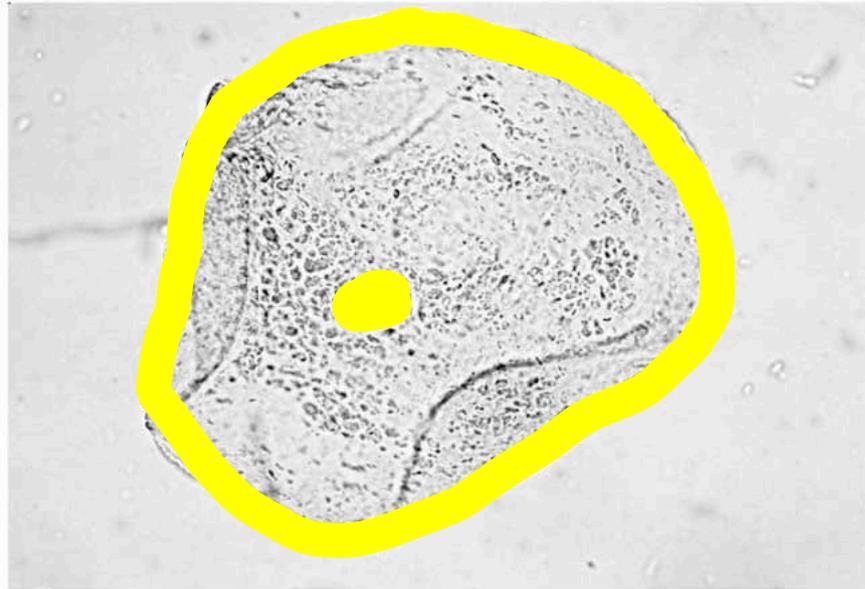| For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

Answer all questions in the spaces provided.

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.
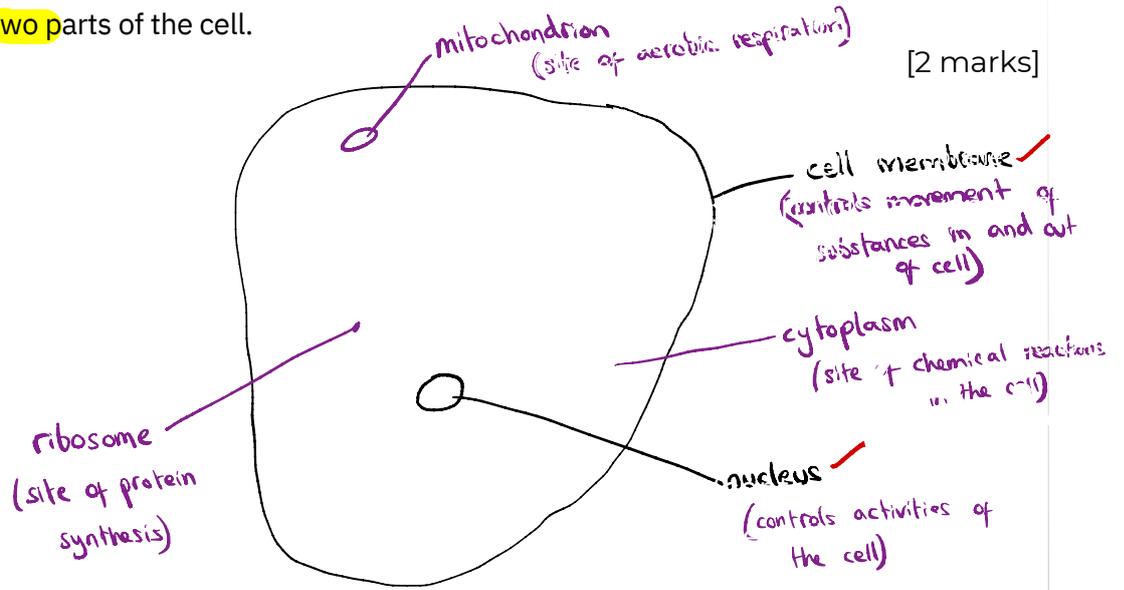
[1 mark]

red blood cell   bacteria / prokaryote   xylem cells

✓   ✗   ↓
because the   have genetic   blood cells
space is needed   material free in the   that don't need
for haemoglobin   cytoplasm (not   a nucleus to
                          membrane bound)   carry out any
                                                        functions

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

Label two parts of the cell.

[2 marks]

Handwritten annotations on diagram:

mitochondrion
(site of aerobic respiration)

cell membrane
(controls movement of substances in and out of cell)

cytoplasm
(site of chemical reactions in the cell)

ribosome
(site of protein synthesis)

nucleus
(controls activities of the cell)

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

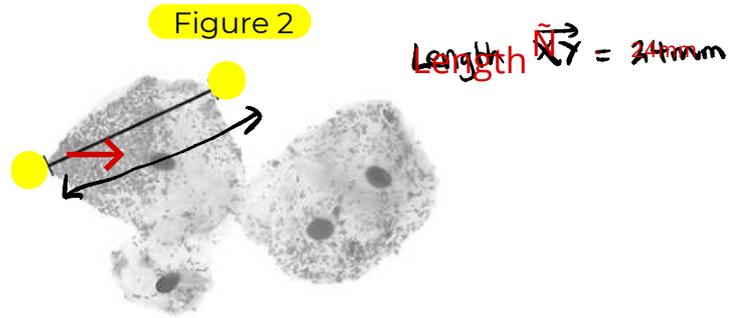[1 mark]

cellulose cell wall   chloroplast   (permanent) vacuole

Question 1 continues on the next page

Turn over ▶

Figure 2 shows some different cells.

Figure 2

Length XY = 24mm

H 01a.5

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

Calculate the magnification.

Use the equation:

magnification =

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

[3 marks]

Size of image = 24 mm ✓   24m£

Real size = 0.06 mm

$\frac{24}{0.06}$ 2÷9É magnification

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

Magnification =   4.00 ✓

×

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]

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

1 higher magnification

2 higher resolution / resolving power

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

10

tTurn over for the next question o-do

Mosquitoes carry a pathogen that causes malaria.

What type of pathogen causes malaria?

Tick () one box.

[1 mark]

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		—	—

112840

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

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 F-

2011 97

2013 94 2-3 Predict-

2015 92 2-2

) -3

) -2

Eg. g. Predict another
-2
92-2=90 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

0 2 6 Describe how the human body:

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

(Prevention of entering)

- Skin acts as a barrier ✓, oil on the surface that repels pathogens ✓ 'sebum'

scabs form over cuts / scabs form a barrier ✓

- Eyes produce tears ✓, tears are antiseptics, 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 ✓

(Examiner notes in margin:)
→ Logical order
Well explained points
Include both bullet points

?nW[?e
repels pathogens

11

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

0 3   This question is about photosynthesis.

0 3.1   Complete the word equation for photosynthesis:

[2 marks]

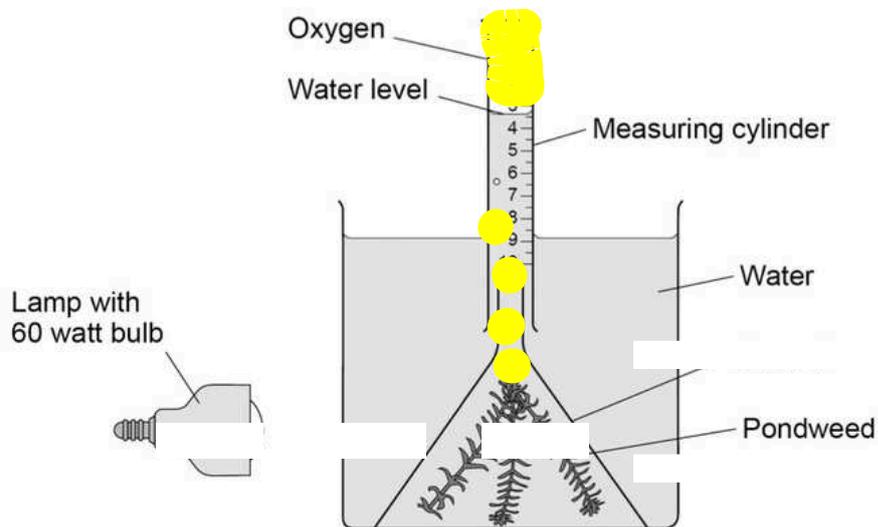carbon dioxide   +   water $\longrightarrow$ glucose   + oxygen

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.

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

→ the variable the variable you change

Tick (✓) one youchangebox.

[1 mark]

Power output of bulb ✓

Rate of photosynthesis ☐

Time to collect oxygen ☐

Volume of oxygen collected ☐

0 3 . 3 Suggest two ways the method could be improved so the results would be more valid.

[2 marks]

1 Do Do repeats and calculate the mean

2 Control the water temperature

– Control the distance between the bulb and pondweed
– Control the mass/length/species of the pondweed
– Give pondweed time to equilibrate ⟶ get used to the conditions

Table 3 shows the student's results.

Table 3

Power output of bulb in watts	Volume of oxygen collected in 20 minutes in cm3	Rate of photosynthesis in cm3/hour
60	0.5	1.5
100	0.8	2.4
150	1.1	X = 3.3 0.3
200	1.2	3.6
250	1.2	3.6

0 3 . 4   Calculate value X in Table 3.

[1 mark]

1.1cm² = 20 mins of photosynthesis   60÷20=3

1.1×3=3.3   3.3   3.3=60 60 mins of photosynthesis

X = _____ 3.3 _____ cm3/hour

| 0 | 3 | 5 |

Complete Figure 4.

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.

Figure 4

Table 3

Power output of bulb in watts	Volume of oxygen collected in 20 minutes in cm³	Rate of photosynthesis in cm³/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

Rate of photosynthesis in cm³/hour
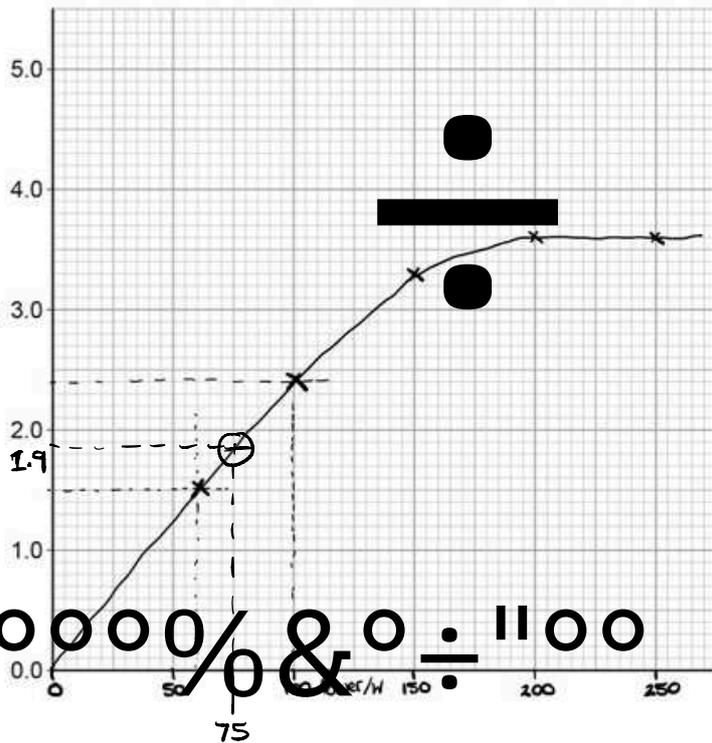
−Independent variable on x-axis

− Dependent variable on y-axis

Dependent variable on y-axis

Determine the expected rate of photosynthesis with a bulb of power output 75 watts. Use Figure 4.

[1 mark]

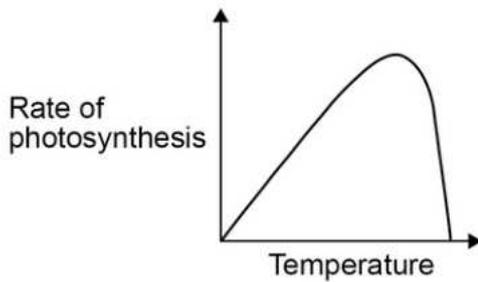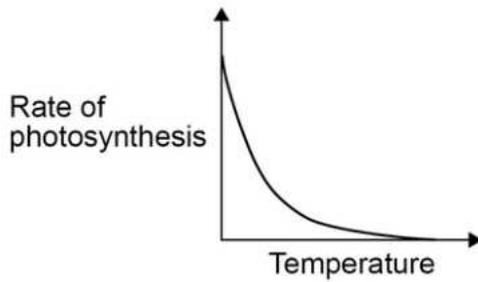Rate of photosynthesis at 75 watts = 1.9 cm3/hour

Turn over ▶

0	3	7

Which graph shows the effect of temperature on the rate of photosynthesis?

[1 mark]

Tick () one box.

Rate of photosynthesis — Temperature

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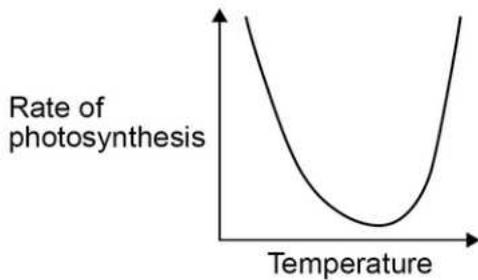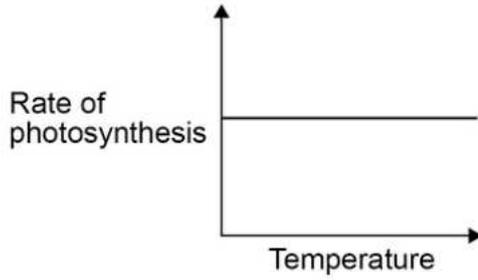
As temperature increases the rate of photosynthesis increases until the temperature is so high that it is damaging to the plant

Rate of photosynthesis — Temperature

✓

1

Rate of photosynthesis — Temperature

✓

Rate of photosynthesis — Temperature

☐

12

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
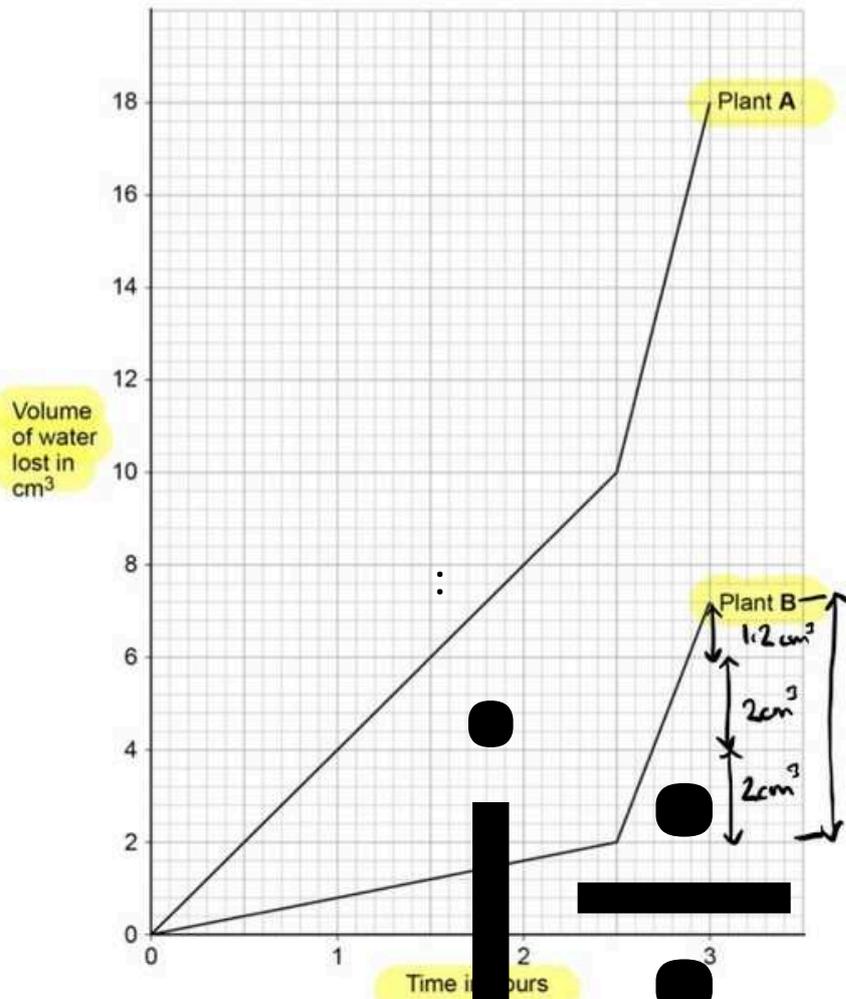
→ MgS accepts between guard cells

Turn over ▶

15

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

Both plants were kept together.

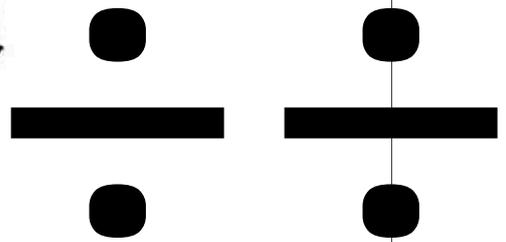Figure 5 shows the student's results.

Figure 5

tAG ←

Figure 5

Volume of water lost in cm^3

18
16
14
12
10
8
6
4
2
0

Plant A

Plant B
$1.2 \, cm^3$
$2cm^3$
$2cm$

Water lost = $5.2 cm^3$

0   1   2   3

Time in hours

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.

which water loss

f) *holes through which water loss can occur*

[1 mark]

- Plant A has more stomata

- Plant A has more leaves

- Plant A has bigger leaves → *increases surface area*

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 cm³ ✓

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

= 10.4   =3 3 s.f

Rate of water loss = ___10___ cm3/hour   2 s.f

B 0 4 B . 5 Suggest two reasons why the rate of water loss in both plants changed after 2.5 hours.

[2 marks]

1 *it* it was warmer   it was less humid

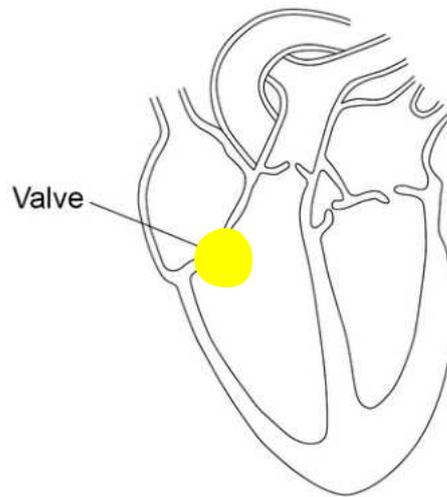2 *light intensity was higher*   it was windier

10

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

One of the heart valves is labelled.

Figure 6

Valve

Sometimes a valve in the heart can start to leak.

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 respiration occurs
- Less Energy released, so less efficient muscle contraction
- Anaerobic respiration occurs, causing oxygen debt and the buildup of lactic acid
- Buildup of lactic acid causes muscle fatigue

- Less efficient removal of carbon dioxide

(teacher annotations in purple:)
- Identify relevant points
- Explain with logical order
- Explain with logical order

(annotations:) with O_2 · Contraction · shortage of O_2 in body tissues

Question 5 continues on the next page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Turn over ▶

19

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.

shows the data.
Table 4

Table 4

	Type of replacement heart valve	
	Mechanical	Bio-logical
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
Number of patients who died from heart-related problems after valve replacement		
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

% Patients who died after mechanical valve :

$\frac{180}{2852}$ × 100 = 6.31 ≈ 6% ✓

% Patients who died after biological valve :

$\frac{178}{1754}$ × 100 = ≈ 10% ✓

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

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]

(Student handwritten response and examiner annotations:)

Link

- 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 → which 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-threatening issues like heart attacks (etc). Blood thinners also not needed, so fatal bleed less likely

Table 4

	Type of replacement heart valve	
	Mechanical	Biological
Number of patients given the valve	2852	1754
Number of patients who died from heart problems within 5 years of getting the replacement valve		
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

Turn over ►

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 f-Immuneresponse ← 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

M ao

0 6.3 Describe a test that could be used to show that a person's urine contains glucose.

[2 marks]

Test AddBenedict's reagent to sampleandheat/boil

Add Benedict's reagent to sample and heat/boil

Positive result colour change from blue to brick red

colour change from blue to brick red

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 why untreated 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 . 5

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

The small intestine is adapted for efficient absorption.

Describe how the small intestine is adapted for efficient absorption.

[5 marks]

→ projections

Good

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 transport

12

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.

The heart of the axolotl has only one ventricle.

0 7 . 2   Label the ventricle on Figure 7.

[1 mark]

[No solution due to redacted image]

*2 4 *

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 mix, so less oxygen reaches body cells/ tissues.

Figure 8 shows an axolotl.

Figure 8

EBay

Gills
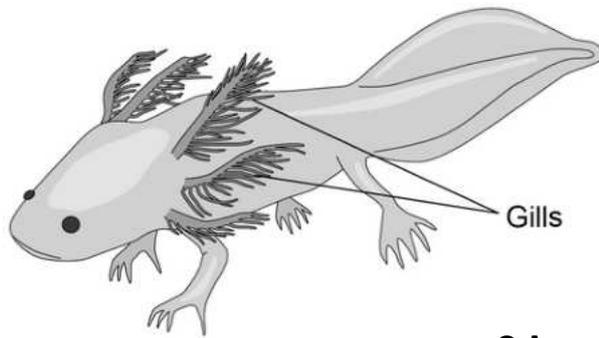
-0A

0 7 4 Explain why an xolotl ma die in water with a low concentration of oxygen.
[4 marks]

Explain why an axolotl may die in water with a low concentration of oxygen.
[4 marks]

- Concentration gradient of oxygen is shallower ← i.e. the difference between concentration of O_2 in the water and in the axolotl is smaller

therefore less oxygen diffuses into the gills of the axolotl (and therefore its blood)

- 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

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   – Cystic fibrosis

– cancer   – 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

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 catalyst reactions in living organisms

(Biological catalyst)

0 8 . 2 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 how

[4 marks]

- 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 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]

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

or

Cells divide

Pancreatic cancer cells

and
are
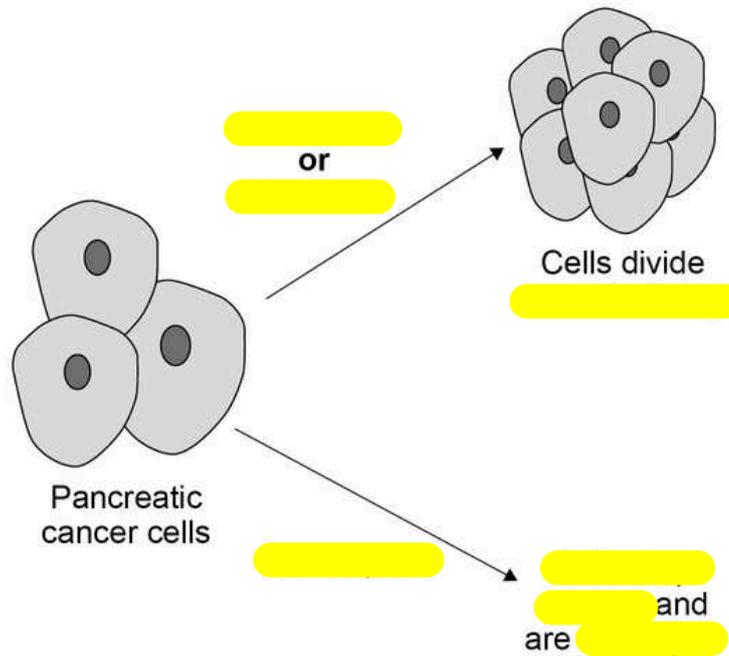
Scientists have developed a drug that inhibits enzyme A.

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 tumours. 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

-Question 8 continues on the

0 8 6

The drug was trialled before it was licensed for use.

To improve validity of the results in the trial:
F-how accurately the → 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 ☑

rÉtigal — Identical copies of one type of antibody

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

Explain how the monoclonal antibody works to treat pancreatic cancer.

[3 marks]

f) → toxin/drug/chemical
↳ Whatever is being used to kill tumour

- Monoclonal antibody is attached to radioactive substance.

- Monoclonal antibody will only attach to cancerous cells // tumour

- Radioactive substance will find 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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oEND OF QfUESTIOfNS

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ANSWER IN THE SPACES PROVIDED