

Name _____



Triple Science

Higher

Biology: Paper 1

Please write clearly in block capitals.

Centre number

Candidate number

Surname
Forename(s)
Candidate signature

GCSE BIOLOGY

Higher Tier Paper 1H

Tuesday 14 May 2019 Afternoon Time allowed: 1 hour 45 minutes

Materials

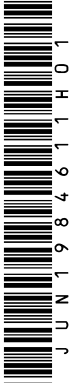
- For this paper you must have:
- a ruler
- a scientific calculator.

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.



Answer all questions in the spaces provided.

01

Figure 1 shows an animal cell viewed using a microscope.

Figure 1



01.1

The cell contains a nucleus.

What is the function of the nucleus?

[1 mark]

01.2

Name one type of cell that does not contain a nucleus.

[1 mark]



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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]

Question 1 continues on the next page

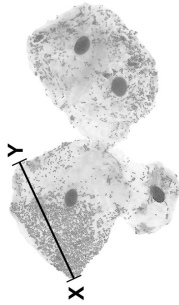
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Figure 2 shows some different cells.

Figure 2



0 1 . 5 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]

Magnification = ×



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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This question is about photosynthesis.

0 3

Complete the word equation for photosynthesis:

0 3 . 1

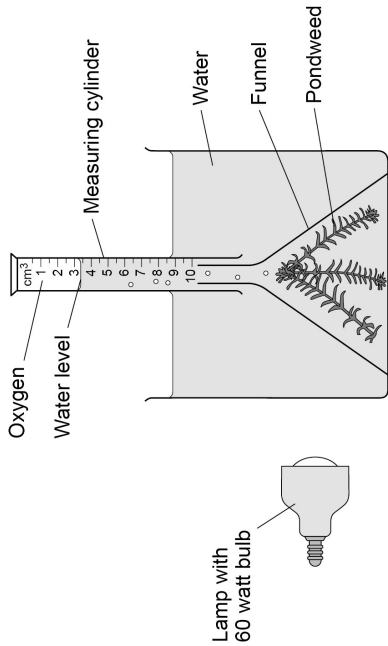
[2 marks]

+ _____ → _____ + oxygen

A student investigated photosynthesis using pondweed.

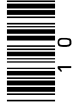
Figure 3 shows the apparatus the student used.

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

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2

 What was the independent variable in the investigation?

Tick (✓) **one** box.

- Power output of bulb

☐
- Rate of photosynthesis

☐
- Time to collect oxygen

☐
- Volume of oxygen collected

☐

[1 mark]

0

3

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3

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

[2 marks]

- 1
- 2
-
-

Question 3 continues on the next page

Turn over ►



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
200	1.2	3.6
250	1.2	3.6

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

[1 mark]

X = _____ cm³/hour



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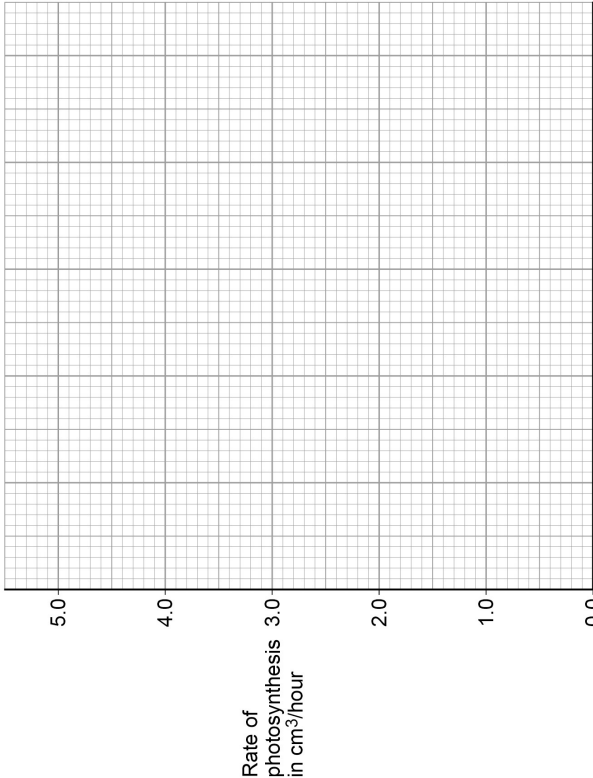
5

 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.

Figure 4



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6

 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 = _____ cm³/hour

Turn over ►



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7

 Which graph shows the effect of temperature on the rate of photosynthesis? [1 mark]

Tick (✓) **one** box.

Rate of photosynthesis	☐
Rate of photosynthesis	☐
Rate of photosynthesis	☐
Rate of photosynthesis	☐



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

How is the volume of water lost from the leaves controlled?

[1 mark]

Describe the transport of water through a plant from the roots to the atmosphere.
[3 marks]

Describe the transport of water through a plant from the roots to the atmosphere. [3 marks]

[3 marks]

Question 4 continues on the next page

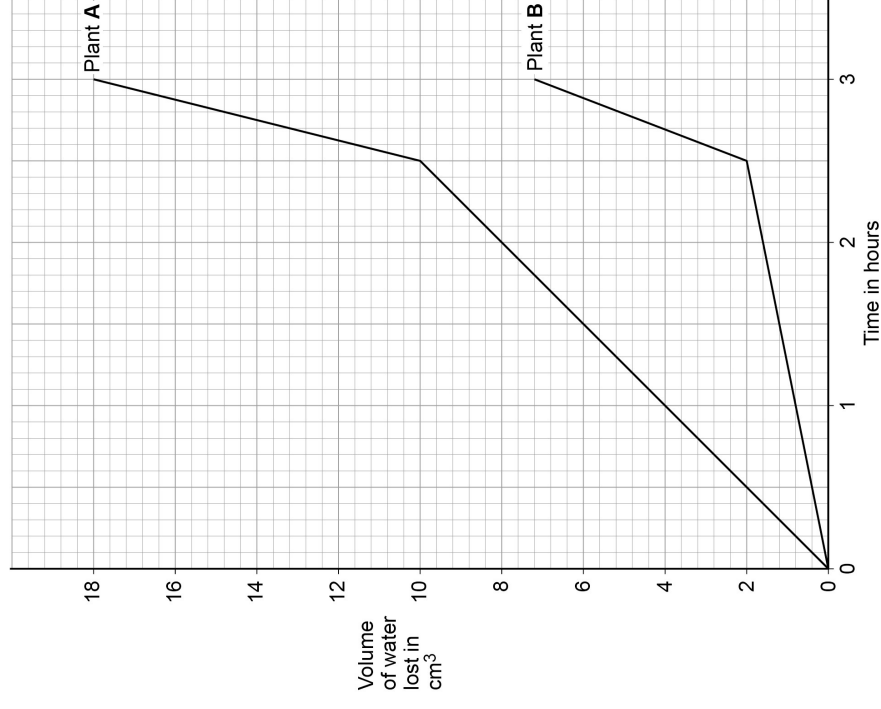


A student investigated the volume of water lost from two plants of different species.

Both plants were kept together.

Figure 5 shows the student's results.

Figure 5



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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]

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

0

4

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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]

Rate of water loss = _____ cm³/hour

0

4

.

5

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

[2 marks]

1

2

10

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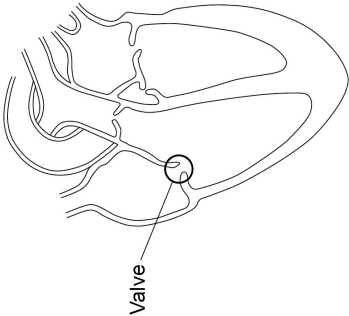


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Figure 6 shows the internal structure of the human heart.

One of the heart valves is labelled.

Figure 6



Sometimes a valve in the heart can start to leak.

0

5

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1

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

[4 marks]



Question 5 continues on the next page

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ANSWER IN THE SPACES PROVIDED



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]



06.4

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]

06.5

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]

12

Turn over ►



07

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

07.1

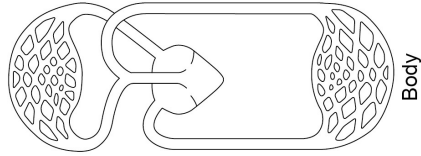
Define the term double circulatory system.

[1 mark]

Figure 7 shows the double circulatory system of the axolotl.

Figure 7

Gas exchange surfaces



07.2

The heart of the axolotl has only one ventricle.

Label the ventricle on Figure 7.

[1 mark]



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

07.3

[2 marks]

Figure 8 shows an axolotl.

Figure 8



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

07.4

[4 marks]

Turn over ►



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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.

07.5

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

[1 mark]

07.6

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

[1 mark]

07.7

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

[1 mark]

07.8

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

Suggest **one** reason why.

[1 mark]



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]

0 8 . 2 Carbohydrrase is an enzyme produced by the pancreas.

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

1

2

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.

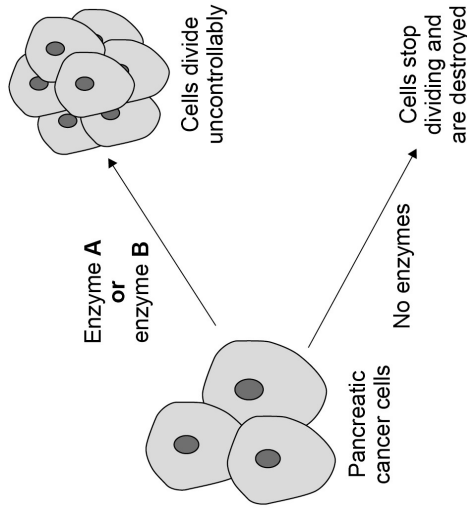
[4 marks]

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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



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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.

08.4

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

Use information from **Figure 9**.

[3 marks]

08.5

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]

Question 8 continues on the next page

Turn over ►



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The drug was trialled before it was licensed for use.
To improve validity of the results in the trial:

- 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

A double-blind trial

08.7

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

What is the next stage in the drug trial?

Tick (✓) **one** box.

Testing on all patients with the disease

Testing on human tissue

Testing on live animals

Testing on volunteers with the disease

[1 mark]



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08.8

A monoclonal antibody has been produced to treat pancreatic cancer.

Explain how the monoclonal antibody works to treat pancreatic cancer.

[3 marks]

END OF QUESTIONS



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Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	controls the (activities of the) cell	allow contains genetic information / genes / DNA / chromosomes do not accept brain do not accept controls substances entering / leaving the cell	1	4.1.1.2 AO1
01.2	red blood cell / RBC or bacteria / prokaryote or xylem (cell)	allow erythrocyte ignore blood cell unqualified ignore platelets allow named examples of bacteria do not accept virus	1	4.2.2.3 4.1.1.1 AO1
01.3	cell shape is similar to cell in Figure 1 and nucleus present any two features correctly identified and labelled: • nucleus • (cell) membrane • cytoplasm • mitochondria / mitochondrion • ribosome(s)	ignore shading do not accept a cell wall drawn allow cell wall if drawn and correctly labelled do not accept other plant sub-cellular structures	1 1	4.1.1.2 AO2 8.2.1 AO1
01.4	any one from: • (cellulose cell) wall • chloroplast • (permanent) vacuole	ignore chlorophyll allow starch grain	1	4.1.1.2 AO1

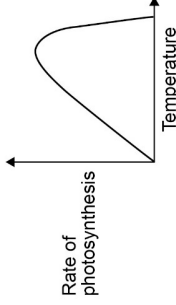
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	24 (mm) or 2.4 (cm) $\frac{24}{0.06}$ or $\frac{2.4}{0.06}$ (×) 400	an answer of (×) 400 scores 3 marks an answer of (×) 40 scores 2 marks allow in range 23 to 25 (mm) or in range 2.3 to 2.5 (cm) allow correct calculation from their measurement of X to Y in the range 2.3 cm to 3.5 cm or 23 mm to 35 mm allow correct magnification derived from their measurement in mm ignore rounding errors	1 1 1	4.1.1.5 AO2
01.6	high(er) magnification high(er) resolution or high(er) resolving power	ignore bigger / zoom allow see more detail if neither mark awarded allow 1 mark for see smaller objects or see smaller sub-cellular structures allow 3D image	1 1	4.1.1.5 AO1
Total			10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	a protist		1	4.3.1.5 AO1
02.2	lower percentage of people with malaria when using (mosquito) nets	allow converse if clearly describing people who do not use (mosquito) nets allow fewer people with malaria when using (mosquito) nets allow only 1.2% of people with malaria when using (mosquito) nets ignore reference to data from table unqualified do not accept incorrectly calculated figures	1	4.3.1.5 AO3
02.3	any one from: - some people who use (mosquito) nets have malaria - data from only one area / part of Africa - size of group too small or sample size too small or only 476 people - only 50 people did not use (mosquito) nets or uneven group sizes (nets vs. no nets) - no other information about people considered people may have lied about using (mosquito) nets	allow people can get malaria when they are not sleeping allow correlation does not imply causation allow examples of information not considered e.g. age, other medical issues such as sickle cell, whether taking anti-malarial medication, vaccination ignore ref to other factors unqualified	1	4.3.1.5 AO3
02.4	any value between 88 – 91	allow decimal values	1	4.3.1.5 AO2

Question	Answers	Extra information	Mark	AO / Spec.. Ref
02.5	any one from: - improved health care - use of mosquito control methods - changing behaviour to avoid being bitten (by mosquitoes)	allow examples of improved health care such as more / cheaper / new treatments / vaccinations / antibiotics allow descriptions such as spraying of insecticides / repellent or draining water holes or preventing mosquitoes from breeding allow descriptions such as wear long clothing or avoid going out at dusk	1	4.2.2.5 4.3.1.5 AO2

Question	Answers	Mark	AO / Spec. Ref.
02.6	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	4.3.1.6 4.3.1.7 AO1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content <i>prevents pathogens from entering skin</i> - tough / dry / dead outer layer - skin acts as a barrier - sebum / oil on (surface of) skin - sebum / oil repels pathogens - scabs form over cuts or scabs form a barrier - platelets are involved in forming clots / scab stomach - contains (hydrochloric) acid (HCl) kills bacteria - in food or in swallowed mucus eyes - produce tears - contains enzymes to kill bacteria - tears are antiseptic breathing system - trachea / bronchi / nose produce mucus - mucus is sticky (mucus) traps bacteria (mucus) carried away by cilia <i>defends itself against pathogens inside the body</i> - immune system / white blood cells (WBCs) - WBCs engulf pathogens - antitoxins are produced (antitoxins) neutralise toxins / poisons (produced by pathogen) - antibodies are produced (antibodies) help destroy pathogens - memory cells (are formed) (memory cells give a) more rapid response if pathogen re-enters a level 2 response should refer to body defence and the immune system		
Total		11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	LHS: carbon dioxide and water RHS: glucose	words take precedence over symbols allow correct symbols (ignore balancing) in any order do not accept starch ignore carbohydrates / sugar	1 1	4.4.1.1 AO1
03.2	power output of bulb		1	4.4.1.2 AO2
03.3	any two from: • repeat and calculate a mean or repeat and to eliminate anomalies • control the (water) temperature • control the concentration of carbon dioxide • control the distance of the bulb from the pondweed • control the mass / length / species / age of the pondweed • give pondweed time to equilibrate	ignore do a control experiment unqualified allow a method of controlling (water) temperature allow a method of controlling carbon dioxide concentration allow use the same piece of pondweed allow do experiment with the bulb off / in the dark	2	4.4.1.2 AO3
03.4	3.3 (cm ³ /hour)		1	4.4.1.2 AO2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	correct scale and axis labelled all points plotted correctly	max 3 marks for bar chart allow points plotted to within $\pm \frac{1}{2}$ small square allow 3 or 4 correct plots for 1 mark allow correct plot from incorrect value calculated in question 03.4 ignore line extended beyond 60 / 250 (W) ignore line joined point to point with straight lines	1 2 1	4.4.1.2 AO2
03.6	correct answer from their line drawn on Figure 4	allow $\pm \frac{1}{2}$ small square tolerance allow 1.8 / 1.9 if no line of best fit or incorrect graph is drawn	1	4.4.1.2 AO2
03.7			1	4.4.1.2 AO2
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(by the guard cells) opening and closing the stomata	ignore ref to guard cells being plasmolysed / turgid	1	4.2.3.2 AO1
04.2	(water is) transported in xylem	ignore mechanism of water entering the roots	1	4.2.3.2 AO1
	water evaporates (from leaves)	do not accept translocation allow loss of water vapour	1	
	through the stomata	allow between the guard cells if no other marks awarded allow 1 mark for reference to transpiration	1	
04.3	any one from: - plant A has more stomata - plant A has more leaves - plant A has bigger leaves - plant A has a greater total surface area of leaves	allow converse for plant B allow (the plants) have different numbers of stomata allow (the plants) have different numbers of leaves allow (the plants) have different sized leaves allow (the plants) have different total surface area of leaves allow plant A has less (waxy) cuticle or (the plants) have different amounts of (waxy) cuticle allow plant A has fewer hairs on leaves or (the plants) have different number of hairs on the leaves	1	4.2.3.2 AO2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	5.2	an answer of 10 scores 3 marks allow in range 4.8 to 5.6	1	4.2.3.2 AO2
	(5.2 × 2 =) 10.4 or $\left(\frac{5.2}{0.5} =\right) 10.4$	allow their calculated value in the range 8.8 to 12.0	1	
	10 (cm ³ /hour)	allow their calculated value in the range 8.8 to 12.0 correct to 2 significant figures	1	
04.5	(rate increased because) any two from: (it was) warmer - light intensity was higher (it was) less humid	answers must be comparative allow greater water vapour gradient between leaves and environment	2	4.2.3.2 AO3
Total			10	

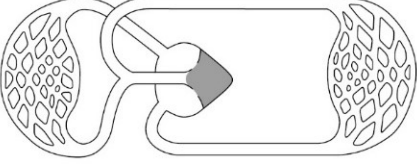
Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	Level 2: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.		3–4	4.2.2.4 4.2.2.2 4.1.3.1 AO2
	Level 1: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.		1–2	
	No relevant content		0	
	Indicative content: • backflow can occur or some blood flows backwards • less blood leaves the heart or less blood is pumped around the body or some blood stays in the heart (instead of being pumped out) or reduced blood pressure or reduced flow rate • less oxygen supplied to muscles / cells • (so) less aerobic respiration • (so) less energy released • (so) less (efficient) muscle contraction • anaerobic respiration takes place • less (efficient) removal of lactic acid or lactic acid builds up or oxygen debt occurs • (lactic acid building up) causes muscle fatigue • less (efficient) removal of carbon dioxide (from blood) a level 2 response should refer to both respiration and the effects on exercise			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	(deaths mechanical valve =) 6% / 6.31136%	ignore raw numbers from Table 4 allow correctly rounded value	1	4.2.2.4 AO3
	(deaths biological valve =) 10% / 10.14823%	allow correctly rounded value	1	
	(therefore a) higher proportion / percentage of patients die with biological valve or patients are more likely to die with biological valve	do not accept more patients die with a biological valve	1	AO2
		allow 2 marks for ratio mechanical : biological = 1:1.6 or 1:1.7 or correctly calculated value allow 3 marks for deaths with biological valves = 4% / 3.83687% higher or correctly rounded value or patients are 1.6 / 1.7 times more likely to die with biological valves if no other marks awarded, allow for 1 mark chance of death after a valve replacement is 8% / 7.77247% or correctly rounded value		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	platelets	allow thrombocytes	1	4.2.2.3 AO1
05.4	Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.		5–6	4.2.2.4 AO2 AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.		3–4	
	Level 1: Relevant points are made. They are not logically linked.		1–2	
	No relevant content		0	
	Indicative content: mechanical valves - longer lasting or more durable or don't wear out as easily or less likely to need replacing (within 6 years) - blood clots (on the brain) are more likely (after surgery) - patient has to take anti-clotting medication (for the rest of their lives) - if medication not taken (correctly), clots can lead to blood clots on brain / heart attack - medication can lead to excessive bleeding (after injury) - some patients say they can hear the valves opening and closing - survival rate at 5 years is slightly higher for mechanical valve - lower percentage of deaths due to heart-related problems biological valves - no additional medication required - ethical issues surrounding use of animal tissue - valve may harden - more likely to need further operation or another new valve - more likely to be rejected - more likely to need (immuno-suppressant) medication both valves - both are readily available - little wait time			
Total			14	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	plasma		1	4.2.2.3 AO1
06.2	Benedict's (reagent / solution)	allow Fehling's (reagent / solution)	1	4.2.2.1 AO1
06.3	add chemical / Benedict's (reagent to urine) and boil / heat	allow ecf from question 06.2	1	4.2.2.1 AO1
		allow any temperature above 65 °C		
		ignore water bath unqualified		
06.4	the blood is more concentrated or less dilute (than the solution in the cells)	allow orange / yellow / green / brown	1	
		if no other mark awarded, allow 1 mark for reference to glucose testing stick / strip		
		allow the solution in the cells is less concentrated or more dilute than the blood		
06.4	(so) water moves out of cells by osmosis	allow correct references to water concentration or water potential or hypotonic / hypertonic		
		ignore reference to amount of water or glucose		
		allow (so) water moves into the blood by osmosis	1	4.1.3.2 AO2
06.4	water moves through a partially permeable membrane	allow semi-permeable / selectively permeable membrane	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	projections / folds / villi provide a large surface area	ignore small intestine has a large surface area	1	4.1.3.1 4.1.3.3 4.2.2.1 4.1.1.2 AO1
	walls of projections / folds / villi / capillaries are thin / one cell thick for shorter absorption / diffusion distance	do not allow cilia	1	
	(small intestine is) very long, increasing time (for absorption)		1	AO2
	good / efficient blood supply to maintain concentration gradient	allow many capillaries to maintain concentration gradient	1	AO1
	cells have many mitochondria for (aerobic) respiration for active transport or cells have many mitochondria for energy release for active transport	do not accept anaerobic do not accept producing energy	1	AO2
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	blood is pumped to the lungs by one / right side of the heart and blood is pumped to the body by the other / left side of the heart	allow blood enters the heart twice for every (one) circuit around the body	1	4.2.2.2 AO1
07.2	ventricle correctly identified as any part of grey area below: 		1	4.2.2.2 AO2
07.3	oxygenated and deoxygenated blood mixes (so) less oxygen reaches the body / tissues / cells	allow some deoxygenated blood is sent to the body / tissues / cells allow named tissues / organs	1 1	4.2.2.2 AO3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	concentration gradient (of oxygen) is shallow(er) / less steep (therefore) less oxygen diffuses into blood / cells / gills (so) less (aerobic) respiration occurs so less energy is released / available or (so more) anaerobic respiration occurs so less energy is released / available (so) less metabolism or (so when) anaerobic respiration occurs, lactic acid is produced (and is toxic)	allow idea that concentration gradient is negative (i.e. out of axolotl) (1) so oxygen diffuses out of axolotl's blood / cells / gills (1) do not accept no respiration occurs do not accept energy production ignore reduced living processes unqualified allow reduction of building larger molecules or movement / muscle contraction or keeping warm or urea formation or chemical reactions	1 1 1 1	4.4.2.3 4.4.2.1 4.1.3.1 AO2
07.5	stem (cells)	do not accept embryonic stem cell	1	4.1.2.3 AO2
07.6	any one from: • paralysis • diabetes	allow other examples such as Parkinson's / heart disease / stroke / cystic fibrosis / cancer / burns do not accept infectious diseases	1	4.1.2.3 AO1
07.7	any one from: • easy to breed • easy / cheap to keep / rear (as are small) • don't take up much space	allow reproduce quickly allow reference to not being dangerous (to the scientist) allow they are not endangered allow removal of gill will not kill the axolotl	1	4.1.2.3 AO3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.8	any one from: • it's not a mammal or it is an amphibian • regeneration in gills may be different to that in other organs • metabolism / body processes are too different to humans	allow humans do not have gills allow it's an endangered species or species need to be protected from extinction ignore reference to genetic differences or ethics	1	4.1.2.3 AO3
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	any one from: (chemical which) catalyses / speeds up reactions in living organisms (chemical which) catalyses / speeds up biological reactions idea of specificity or (is a) protein	allow biological catalyst allow reduces activation energy (of reactions) in living organisms allow made of amino acids	1 1	4.2.2.1 AO1
08.2	salivary gland small intestine	ignore mouth ignore liver allow duodenum / ileum ignore intestine unqualified do not accept large intestine	1 1	4.2.2.1 AO1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	reduced / no enzyme production / release (from pancreas) food is not broken down fully or food is not digested fully plus any one of the following routes for max 2 marks: less glucose / sugar absorbed or less glucose / sugar passes into the blood(stream) (so) less glucose available for respiration so more (body / stored) fat used up in metabolism / respiration or fewer amino acids absorbed or fewer amino acids pass into the blood(stream) (1) (so) fewer amino acids are available for making new protein for repair / replacement (1) or fewer fatty acids absorbed or fewer fatty acids pass into the blood(stream) (1) (so) fewer fatty acids available so less fat is stored in the body (1) or chemotherapy / radiotherapy causes nausea / loss of appetite (1) (so) less intake of food (1)	allow named example of enzymes ignore reference to hormones allow no food is broken down / digested allow example mark as pairs ignore glycerol ignore glycerol	1 1 1 1	4.2.2.1 4.4.2.3 4.4.2.1 AO2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	(cancer) cells cannot divide or (cancer) cells are destroyed / killed (so) tumour doesn't grow / get bigger or tumour less likely to spread or tumour less likely to form secondary tumours (because) enzymes A and B are not working / active / effective / present or (because) enzymes A and B are inhibited	do not accept reference to the drug killing (cancer) cells allow cancer cells less likely to spread / metastasise allow reference to both enzymes ignore enzymes unqualified	1 1 1	4.2.2.7 AO3
08.5	(functional) enzyme B would still be made / present (therefore cancer) cells would still divide uncontrollably or (therefore cancer) cells would not be destroyed or (therefore) the tumour will (continue to) grow / get bigger / spread or the tumour will form secondary tumours	allow enzyme B is not inhibited	1 1	4.2.2.7 AO3
08.6	any two from: - to avoid the patients thinking they feel better with the drug or - to take into account a psychological effect - as a control / comparison - to avoid bias(ed results)	ignore to make it more valid unqualified ignore to provide an independent variable	2	4.3.1.9 AO2
08.7	testing on volunteers with the disease		1	4.3.1.9 AO1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.8	monoclonal antibody is attached to radioactive substance / toxin / drug / chemical monoclonal antibody will (only) attach to / target (antigen on) cancer cells / tumour (so) radioactive substance / toxin / drug / chemical will (bind to cancer cells and) stop them growing / dividing	allow radioactive substance / toxin / drug / chemical will kill / destroy the cancer cells OR monoclonal antibody interrupts the cell cycle or monoclonal antibody aids immune response (1) monoclonal antibody will (only) target cancer cells / tumour (1) (so) action of monoclonal antibody stops cancer cells growing / dividing or (so) action of monoclonal antibodies helps immune system kill / destroy cancer cells (1)	1 1 1	4.3.2.2 AO1 AO1 AO1
Total			19	

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.

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.



J U N 2 1 8 4 6 1 1 H 0 1

IB/M/Jun21/E24

8461/1H

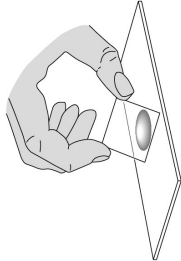
Answer **all** questions in the spaces provided.

01

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

Figure 1 shows the student preparing the cells.

Figure 1



01.1

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

[2 marks]

1

2

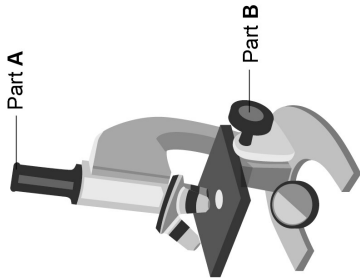


02

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Figure 2 shows the student's light microscope.

Figure 2



Name part A.

[1 mark]

What is the function of part B?

[1 mark]

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]

Question 1 continues on the next page

Turn over ►



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Red blood cells are specialised animal cells.

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

[6 marks]

When placed into a beaker of water:

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

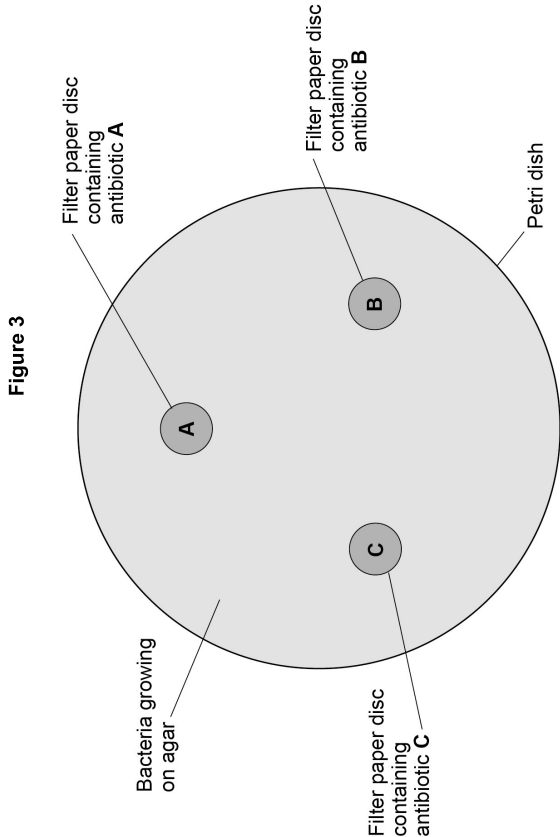
Explain why the red blood cell bursts but the plant cell does **not** burst.

[2 marks]



A student investigated the effectiveness of three different antibiotics.

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



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

Describe **two** aseptic techniques the student should have used.

[2 marks]

1 _____

2 _____

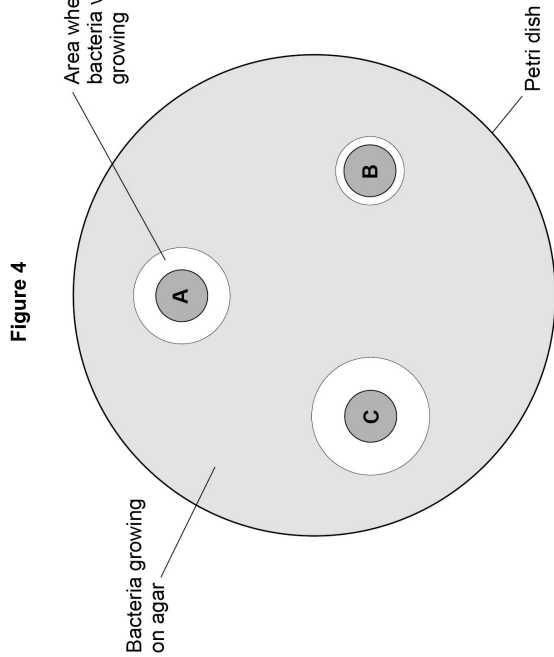
Question 2 continues on the next page

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.



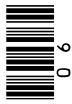
Which antibiotic is the **least** effective?

Give a reason for your answer.

[1 mark]

Least effective antibiotic _____

Reason _____



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

[1 mark]

Tick (✓) one box.

Clinically obese

Normal

Obese

Overweight

Underweight

Calculate value X in Table 1.

03.2

Use the equation:

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

Give your answer to 3 significant figures.

[3 marks]

X = kg/m²

Question 3 continues on the next page

Turn over ▶



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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

03.3 Describe two patterns shown in Table 2 about the effects of BMI category. [2 marks]

1

2



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]**

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]**

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

2

Turn over for the next question

Turn over ►



All living organisms respire.

0

4

.

1

 What is the chemical equation for aerobic respiration? **[1 mark]**
Tick (✓) **one** box.

6O₂ + 6CO₂ → 6H₂O + C₆H₁₂O₆

6H₂O + C₆H₁₂O₆ → 6H₂O + 6CO₂

6H₂O + 6CO₂ → 6O₂ + C₆H₁₂O₆

6O₂ + C₆H₁₂O₆ → 6H₂O + 6CO₂

0

4

.

2

 Name the sub-cellular structures where aerobic respiration takes place. **[1 mark]**

0

4

.

3

 Energy is released in respiration.
Give **two** uses of the energy released in respiration. **[2 marks]**

1

2



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

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

[2 marks]

1 _____

2 _____

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

Tick (✓) **two** boxes.

Carbon dioxide	☐
Ethanol	☐
Glucose	☐
Lactic acid	☐
Water	☐

Question 4 continues on the next page

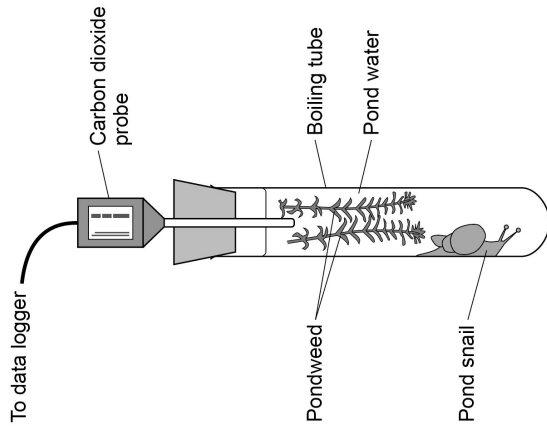
Turn over ►



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.

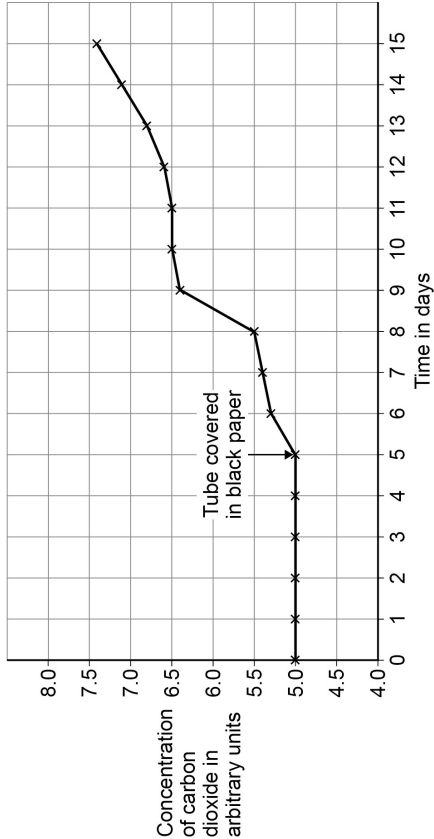
After 5 days, the scientist completely covered the boiling tube with black paper.

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



04.6

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

[2 marks]

04.7

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

[1 mark]

Question 4 continues on the next page

Turn over ►

04.8

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]

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]

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

1

2

3

0 5 . 3 Explain how amylase breaks down starch.

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

[3 marks]

Question 5 continues on the next page

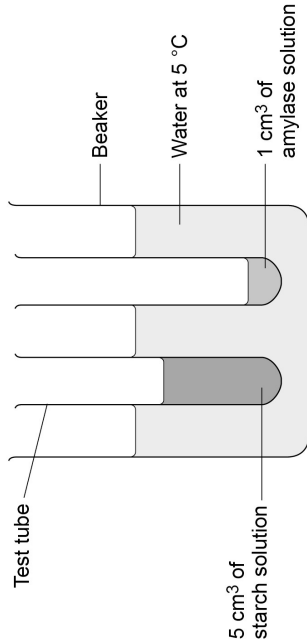
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A student investigated the effect of temperature on the activity of amylase.

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 _____
- 2 _____

0

5

.

5

 Why did the student leave the starch solution and amylase solution for 5 minutes before mixing them? [1 mark]

Question 5 continues on the next page

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]



0	5	.	7
---	---	---	---

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

Use Table 3.

[5 marks]

[illegible]

8	5	0
---	---	---

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]

Turn over for the next question

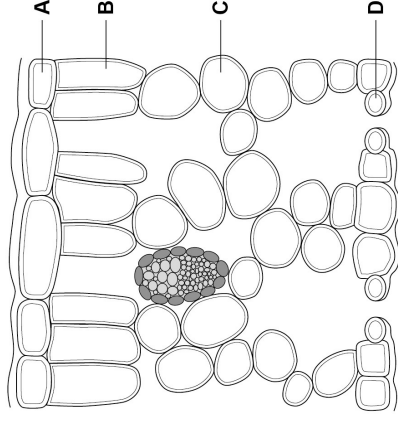
Turn over ►



6	0
---	---

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

1

U

1

D

--	--

0	6	.	2
---	---	---	---

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

[1 mark]

17

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Plants lose water through their leaves.

06.3

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

[1 mark]

06.4

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]

06.5

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

Tick (✓) **one** box.

- Increased humidity
- Increased light intensity
- Increased density of stomata
- Increased temperature

Question 6 continues on the next page

Turn over ►



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

06.6

[6 marks]



Question 6 continues on the next page

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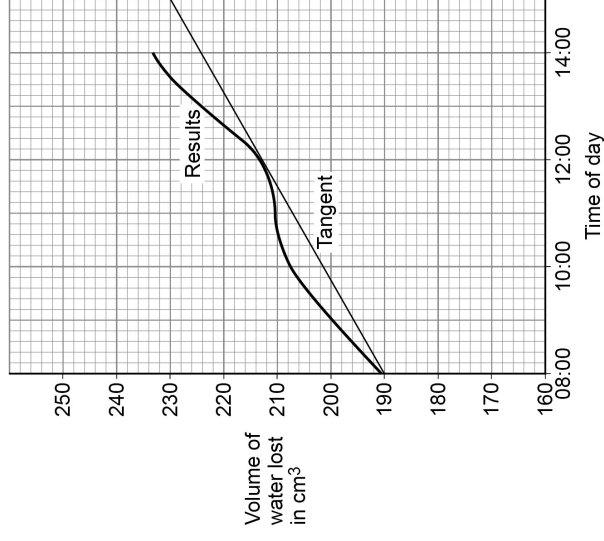
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IB/M/Jun21/8461/1H

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

Figure 10



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06.7

Determine the rate of water loss at 12:00

Use the tangent on **Figure 10**.

Give your answer:

- in cm³ per minute
- in standard form.

[4 marks]

Rate of water loss = _____ cm³ per minute

06.8

The rate of water loss at midnight was much lower than at 12:00

Explain why.

[2 marks]

Turn over for the next question

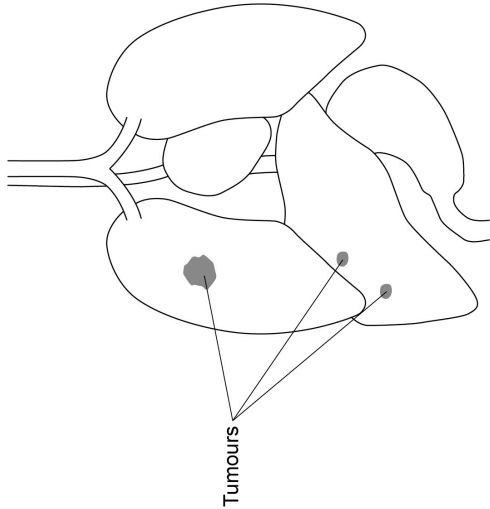
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07

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

Figure 11



Malignant tumours are cancers.

07.1

Describe what happens to cells when a tumour forms.

[1 mark]

07.2

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

[1 mark]



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]

[illegible]

Question 7 continues on the next page

Turn over ►

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

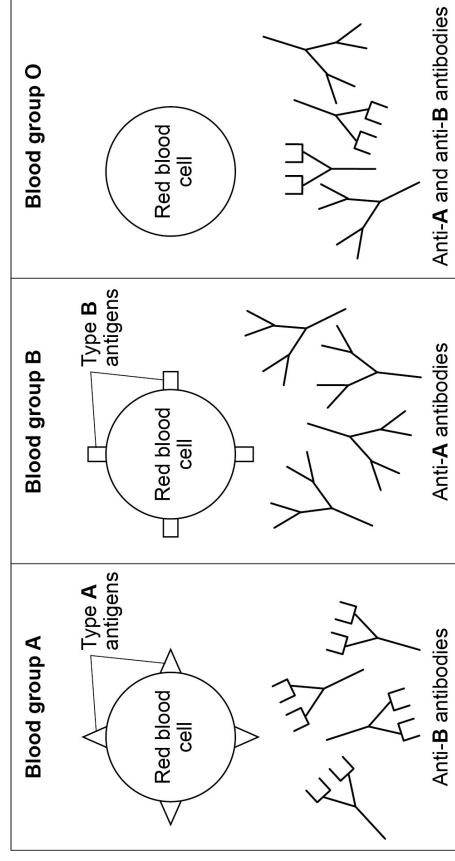
A blood transfusion is where a patient receives blood from a donor.

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 $8\text{ }\mu\text{m}$ in diameter.

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

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

07.4

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]

07.5

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

[2 marks]

Question 7 continues on the next page

Turn over ►



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

Table 4

Risk	Probability of risk occurring
Allergic reaction	0.9%
Hepatitis B infection	1 in (3 × 10 ⁵)
Hepatitis C infection	6.7 × 10 ⁻⁷
Kidney damage	1 in 70 000

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

[1 mark]

Tick (✓) **one** box.

Allergic reaction

Hepatitis B infection

Hepatitis C infection

Kidney damage



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07.7

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]

19

END OF QUESTIONS



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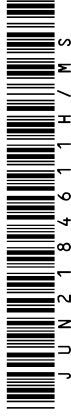
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Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	any two from: • (microscope) slide • cover slip • dye / stain • (mounted) needle • pipette / dropper • scalpel • forceps / tweezers	allow named dye / stain ignore water ignore knife allow swab (to collect cells)	2	AO1 4.1.1.5 RPA1
01.2	eyepiece / lens	do not accept objective lens	1	AO1 4.1.1.5 RPA1
01.3	to focus (the image / cells)	allow to make the cells / image clear(er) allow to improve resolution (of the image) ignore to move the stage up / down do not accept reference to magnification	1	AO1 4.1.1.5 RPA1
01.4	any one from: • no cells in the field of view • slide not in the correct position • mirror not in correct position • (objective) lens not clicked into place or • (objective) lens dirty • (student is) looking at a (large) air bubble • (the microscope is) not focussed	allow light / microscope not switched on / plugged in allow student did not stain the cells allow idea of magnification not being high enough	1	AO3 4.1.1.5 RPA1

01.5	Level 2: Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.		4–6	AO2
	Level 1: Relevant features are identified and differences noted.		1–3	
	No relevant content		0	
	Indicative Content			
Differences: - red blood cell has no nucleus or plant cell has a nucleus - red blood cell has no cell wall or plant cell has a cell wall - red blood cell is a biconcave disc or there are many different shapes of plant cell - red blood cell contains haemoglobin or plant cells do not contain haemoglobin - red blood cells do not contain chlorophyll or plant cells (may) contain chlorophyll - red blood cell has no chloroplasts or plant cell has chloroplasts - red blood cell has no (permanent) vacuole or plant cell has (permanent) vacuole - red blood cells are (much) smaller than plant cells Similarities: both have: - cytoplasm - cell membrane - pigments (although they are different) ignore references to mitochondria and ribosomes for Level 2, consideration of both red blood cells and plant cells is required.				
01.6	water enters (the cells) by osmosis / diffusion	allow water enters and the cell starts to swell ignore explanations of osmosis	1	AO2
	plant cell has a cell wall (which prevents it from bursting)	allow red blood cell has no cell wall (so it swells and bursts)	1	AO1 4.1.3.2 4.1.1.2
Total			13	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	any two from: - sterilise equipment / surfaces (before use) (use) sterilised agar - secure lid of the Petri dish with (adhesive) tape - only lift lid of Petri dish a little (when setting up plate) or lift lid of Petri dish at an angle (when setting up plate)	ignore 'clean' unqualified ignore wash hands allow description of how to sterilise equipment allow description of how to sterilise agar	2	AO1 4.1.1.6 RPA2
02.2	B and it kills the fewest bacteria or it has the smallest area where no bacteria were growing	allow it has the smallest clear / white area	1	AO3 4.1.1.6 RPA2

02.3	an incorrect answer for one step does not prevent allocation of marks for subsequent steps ignore calculation and subtraction of filter paper disc area from total area allow $d = 2.2$ (cm) or $d = 22$ (mm) allow a tolerance of ± 1 mm <i>(correct measurement)</i> $r = 1.1$ (cm) or $r = 11$ (mm) <i>(recall of the equation)</i> πr^2 <i>(calculation/substitution)</i> 3.14×1.1^2 or 3.14×11^2 $= 3.799(4)$ (from 3.14×1.1^2) or $= 379.9(4)$ (from 3.14×11^2) <i>correct unit</i> $(3.7994) \text{ cm}^2$ or $(379.94) \text{ mm}^2$	1 1 1 1 1	AO2 4.1.1.6 RPA 2
02.4	any one from: - repeat and calculate a mean - repeat and eliminate anomalies - use a control disc - use different types of bacteria allow description of control disc e.g. disc with water / nothing ignore set up a control	1	AO3 4.1.1.6 RPA2
Total		9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	normal		1	AO2 4.2.2.5 4.2.2.6
03.2	$92 \div 1.71^2$ $31.46(\dots)$ 31.5	allow correctly calculated value using $92 \div 1.71$	1 1 1	AO2 4.2.2.5 4.2.2.6
03.3	any two from: - the higher the BMI (category) the lower the number of years living in good health - the higher the BMI (category) the higher the number of years living in bad health - the higher the BMI (category), the lower total life expectancy	allow 'more overweight' or 'more obese' for higher BMI category throughout allow the lower the BMI (category) the higher the number of years living in good health allow the lower the BMI (category) the lower the number of years living in bad health allow the lower the BMI (category), the higher total life expectancy if no other marks awarded, allow for 1 mark idea that as BMI increases, quality of life decreases	2	AO2 4.2.2.5 4.2.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	$6O_2 + C_6H_{12}O_6 \rightarrow 6H_2O + 6CO_2$		1	AO1 4.4.2.1
04.2	mitochondria / mitochondrion		1	AO1 4.1.1.2
04.3	any two from: - movement / muscle contraction - keeping warm - active transport - building larger molecules	ignore reference to metabolism unqualified allow examples of movement allow examples of building larger molecules e.g. making (named) proteins / cellulose allow cell division ignore growth	2	AO1 4.4.2.1 4.4.2.3
04.4	any two from: - anaerobic produces lactic acid and aerobic does not - aerobic produces carbon dioxide and anaerobic does not - aerobic produces water and anaerobic does not - aerobic occurs (mainly) in the mitochondria and anaerobic does not - anaerobic releases less energy than aerobic	allow anaerobic creates an oxygen debt and aerobic does not allow anaerobic only occurs in the cytoplasm allow anaerobic releases less ATP (than anaerobic) do not accept anaerobic produces / makes / creates less energy	2	AO1 4.4.2.1
04.5	carbon dioxide ethanol		1 1	AO1 4.4.2.1
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	costs the NHS / UK health service / Government / hospitals more money (because need to pay for) additional surgery / medication / hospital stay to treat stroke / diabetes or more time off work (if in hospital / unwell) (1) (so) employer / Government have to give financial support (1)	allow other correct named conditions e.g. heart attack / immobility / disability / arthritis allow more people unable to work allow (so) decreased productivity (in workplace)	1 1	AO3 4.2.2.6
03.5	allow any one from: - movement issues - loss of job / income - disability - mental health impact of lack of movement or - mental health impact of pain - need to visit the doctor / take medication regularly - may need surgery	allow example of movement issue	1	AO3 4.2.2.6
03.6	<u>type 2</u> diabetes CVD / CHD or heart attack / disease or stroke	allow atherosclerosis allow two named vascular conditions for 2 marks from heart attack or stroke or high blood pressure or high (blood) cholesterol allow cancer allow liver disease	1 1	AO1 4.2.2.4 4.2.2.6
Total			11	

04.6	pondweed takes in CO ₂ for photosynthesis snail and pondweed are respiring producing CO ₂	1 1	AO2 4.4.2.1 4.4.1.1
	if no other mark awarded allow rate of respiration = rate of photosynthesis for 1 mark		
04.7	(no light so) no photosynthesis or plant is not taking in CO ₂ and snail and plant are respiring and so are releasing CO ₂	1	AO2 4.4.2.1 4.4.1.1
04.8	snail is being decayed / decomposed / broken down (by) decomposers / bacteria (in pond water / snail) (therefore) respiration (of decomposers / bacteria) releases CO ₂	1 1 1	AO3 AO2 AO3 4.7.2.2 4.4.2.1
Total		14	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	amino acid(s)	ignore monomers	1	AO1 4.2.2.1
05.2	salivary gland pancreas small intestine	in any order ignore mouth allow duodenum / ileum do not accept large intestine ignore intestine unqualified all three correct for 2 marks two correct for 1 mark	2	AO1 4.2.2.1
05.3	starch / substrate binds to <u>active site</u> (of enzyme) (because) shape of <u>active site</u> and substrate are complementary a chemical reaction occurs to produce smaller molecules or bonds between the (starch) molecules are broken to produce smaller molecules	ignore starch / substrate fits <u>active site</u> (of enzyme) allow shape of starch / substrate and <u>active site</u> allow them to fit together allow maltose / sugars for smaller molecules	1 1 1	AO1 4.2.2.1
05.4	any two from: • time before mixing (starch and amylase) solutions • volume / 5 cm ³ of starch (solution) • volume / 1 cm ³ of amylase (solution) • volume / 1 drop of mixture added to spotting tile • volume / 2 drops of iodine (solution)	ignore time unqualified allow amount as an alternative to volume once only do not accept temperature	2	AO2 4.2.2.1 RPA5
05.5	to allow the solutions to reach the same temperature as the water or to allow both solutions to reach 5 °C	allow so the solutions can equilibrate with the temperature of the water	1	AO2 4.2.2.1 RPA5

05.6	as temperature increases, (amylase / enzyme) activity increases, to 35 °C after which activity decreases	ignore reference to time	1	AO3 4.2.2.1 RPA5
05.7	(iodine is not yellow-brown because) starch is still present or starch has not been broken down at 5 °C amylase / starch / molecules have low (kinetic) energy (therefore) there are fewer (enzyme-substrate) collisions at 80 °C the amylase has been denatured (so) the starch can no longer fit	allow enzyme for amylase and substrate for starch throughout allow fewer enzyme-substrate complexes are formed do not accept the amylase is killed / has died allow the shape of the amylase / active site changes allow the bonds holding the amylase in its (3D) shape have broken	1 1 1 1 1	AO2 4.2.2.1 RPA5
05.8	keep temperature constant (but) change named factor and test a range of values of named factor	named factor e.g. pH or enzyme concentration or substrate concentration	1 1	AO3 4.2.2.1 RPA5
Total			17	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	A		1	AO2 4.2.3.1
06.2	chloroplast(s)	ignore chlorophyll	1	AO1 4.1.1.3 4.2.3.1
06.3	guard (cells)	ignore stoma(ta)	1	AO1 4.2.3.1 4.2.3.2
06.4	transpiration stream	ignore transpiration unqualified	1	AO1 4.2.3.2
06.5	increased humidity		1	AO2 4.2.3.2

06.6	Level 2: Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4–6	AO1 4.2.3.1 4.2.3.2
	Level 1: Relevant features are identified and differences noted.	1–3	
	No relevant content.	0	
	Indicative content: <i>Structure</i> - xylem is made of dead cells - and - phloem is made of living cells - phloem cells have pores in their end walls - and - xylem cells do not have pores in their end walls - xylem is hollow or xylem does not contain cytoplasm - and - phloem contains cytoplasm - xylem contains lignin - and - phloem does not (contain lignin) - both made of cells - both tubular <i>Function</i> - xylem transports water / mineral ions - and - phloem transports (dissolved) sugars - xylem is involved in transpiration - and - phloem is involved in translocation - xylem transports unidirectionally - and - phloem transports bidirectionally - both transport liquids / substances throughout the stem / leaves / roots / plant For Level 2, students must refer to both structure and function of xylem and phloem tissue.		

06.7	(correct division) 40 ÷ 7 (in hours) or 40 ÷ 420 (in minutes)	allow correct answer from student's readings throughout	1	AO2 4.2.3.2
	5.71 (in hours) or 0.0952...(in minutes)	allow correct division from incorrect reading(s) from the tangent	1	
	(correct conversion to minutes) 0.0952...	allow correct conversion at any point in the calculation	1	
	(answer in standard form) 9.5(238) x 10 ⁻²	allow correct conversion of calculated value to minutes	1	
06.8	(less water loss at night)	allow converse if clearly describing 12:00	1	AO3 4.2.3.2
	stomata are (almost completely) closed (because) it's cooler / colder or (because) there's less / no light	ignore it's dark at night	1	
Total			17	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	cells grow / divide abnormally / uncontrollably	ignore mutation	1	AO1 4.2.2.7
07.2	has spread to other parts / organs of the body or has spread to the liver / lung or has formed a secondary tumour	allow tumour has metastasised	1	AO2 4.2.2.7
07.3	Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account. Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear. Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking. No relevant content. Indicative content: <i>Tiredness</i> - fewer red blood cells - so less haemoglobin - so less oxygen transported around the body - so less (aerobic) respiration can take place - so more anaerobic respiration takes place - less energy released for metabolic processes - or less energy released so organs cannot function as well - lactic acid produced (during anaerobic respiration) causes muscle fatigue <i>Frequent infections</i> - fewer white blood cells / phagocytes / lymphocytes - so fewer antibodies produced or less phagocytosis - so fewer pathogens / bacteria / viruses killed <i>Bleeding</i> - fewer platelets - so blood does not clot as easily For Level 3 , reference to all three symptoms must be made.	Level 3: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account. Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear. Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking. No relevant content.	5–6 3–4 1–2 0	AO2 4.2.2.3 4.3.1.6 4.4.2.1 4.4.2.2

07.4	anti-B antibodies in patient / receiver / recipient will bind to type B antigens on person's / donor's red blood cells (so) red blood cells clump together and are wider than capillaries or (so) red blood cells clump together and block capillaries (so) cells have reduced supply of oxygen / glucose or (so) cells can't respire	allow (so) red blood cells clump together and capillaries burst ignore references to energy if no other mark awarded allow antibodies from patient and antigens from donor are matching / complementary shapes for 1 mark	1	AO3
07.5	no antigens (on type O red blood cells) (so) antibodies cannot bind (to the antigens / red blood cells)	allow no clumping (of red blood cells)	1	AO3 4.2.2.3 4.3.1.6
07.6	hepatitis C infection		1	AO3 4.2.2.3 4.3.1.1
07.7	no / less bile reaches the small intestine	ignore less / no bile produced	1	AO3
	(so) less / no emulsification of fat	allow correct description of emulsification do not accept reference to chemical digestion	1	AO1
	(so) smaller surface area for lipase to break down fat		1	AO1
	pH of small intestine is not neutralised / alkaline	allow pH of small intestine is acid / low	1	AO2
	(so) lipase is not at its optimum pH to break down fat	pH (of small intestine) is not suitable for lipase to break down fat	1	AO2 4.2.2.1
Total			19	



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:

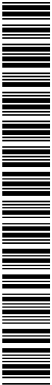
- a ruler
- a scientific calculator.

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.

Information

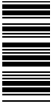
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.



J U N 2 2 8 4 6 1 1 H 0 1

IB/M/Jun22/E20

8461/1H



0 2

IB/M/Jun22/8461/1H

There are no questions on this page

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

01

This question is about cells and transport.

01.1

Complete **Table 1**.

[3 marks]

Table 1

Name of cell part	Function of cell part
	Contains genetic information
Mitochondria	
	Controls the movement of substances into and out of the cell

Cells in potatoes are plant cells.

Cells in potatoes do **not** contain chloroplasts.

01.2

What is the function of chloroplasts?

[1 mark]

01.3

Name **one** type of cell in a potato plant that does **not** contain chloroplasts.

[1 mark]

Question 1 continues on the next page

Turn over ►



A student investigated the effect of salt concentration on pieces of potato.

This is the method used.

1. Cut three pieces of potato of the same size.
2. Record the mass of each potato piece.
3. Add 150 cm³ of 0.4 mol/dm³ salt solution to a beaker.
4. Place each potato piece into the beaker.
5. After 30 minutes, remove each potato piece and dry the surface with a paper towel.
6. Record the mass of each potato piece.
7. Repeat steps 1 to 6 using different concentrations of salt solution.

01.4

What is the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

Concentration of salt solution

☐

Mass of potato piece

☐

Time potato is left in salt solution

☐

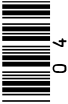
Volume of salt solution

☐

01.5

Why did the student dry the surface of each potato piece with a paper towel in step **5**?

[1 mark]



The student calculated the percentage change in mass of each potato piece.

0 1 . 6

For one potato piece:

- the starting mass was 2.5 g
- the end mass was 2.7 g.

Calculate the percentage increase in mass of the potato piece.

Use the equation:

percentage increase in mass = $\frac{\text{increase in mass}}{\text{starting mass}} \times 100$

[2 marks]

Percentage increase in mass = _____ %

Question 1 continues on the next page

Turn over ►



The student used the results from each potato piece to calculate the mean percentage change in mass at each concentration.

Table 2 shows the results.

Table 2

Concentration of salt solution in mol/dm ³	Mean percentage (%) change in mass
0.0	9.8
0.1	9.5
0.2	7.0
0.3	0.4
0.4	−1.4

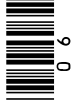
0 1 . 7

Complete Figure 1.

You should:

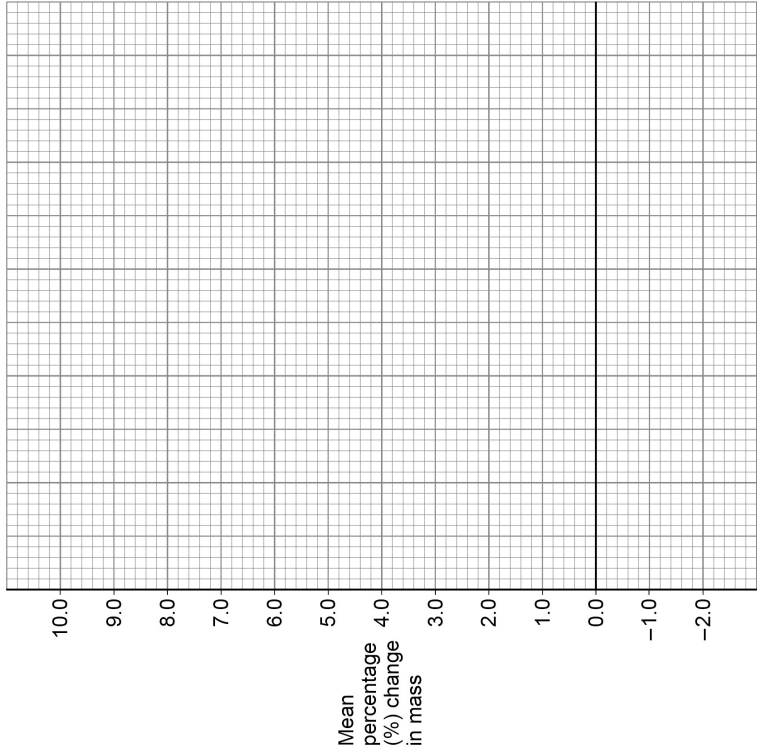
- label the x-axis
- use a suitable scale for the x-axis
- plot the data from Table 2
- draw a line of best fit.

[4 marks]



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Figure 1



What concentration of salt solution was equal to the concentration of the solution inside the potato pieces?

Use Figure 1.

[1 mark]

Concentration = _____ mol/dm³

Question 1 continues on the next page

Turn over ►



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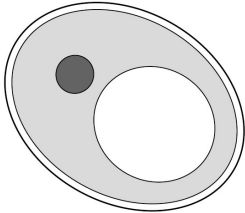
Explain why the potato pieces in the 0.4 mol/dm³ salt solution decreased in mass. [3 marks]



Plant cells and fungal cells are similar in structure.

Figure 2 shows a fungal cell.

Figure 2



Name **one** structure in **Figure 2** which is present in both plant cells and fungal cells but **not** in animal cells.

[1 mark]

Which disease is caused by a fungus?

Tick (✓) **one** box.

- | | |
|-----------------|--------------------------|
| Gonorrhoea | ☐ |
| Malaria | ☐ |
| Measles | ☐ |
| Rose black spot | ☐ |

Question 2 continues on the next page

Turn over ►

A fungal cell divides once every 90 minutes.

How many times would this fungal cell divide in 24 hours?

[2 marks]

Number of times cell divides in 24 hours =



Some types of fungal cell are grown to produce high-protein food.
The high-protein food can be used to make meat-free burgers.

02.4

Where is protein digested in the human digestive system?

Tick (✓) **one** box.

- Large intestine
- Liver
- Salivary glands
- Stomach

[1 mark]

02.5

Which chemical could be used to test if the burgers contain protein?

Tick (✓) **one** box.

- Benedict's reagent
- Biuret reagent
- Ethanol
- Iodine solution

[1 mark]

Question 2 continues on the next page

Turn over ▶

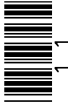


Table 3 shows some information about burgers made from meat and meat-free burgers.

02.6

Table 3

	Mass per 100 g of burger	
	Burgers made from meat	Meat-free burgers
Protein in g	14.0	9.0
Fibre in g	0.9	5.5
Fat in g	16.0	5.2
Carbohydrate in g	15.5	15.1
Cholesterol in mg	120.0	0.0

Evaluate the use of burgers made from meat compared with meat-free burgers in providing humans with a healthy, balanced diet.

Use information from **Table 3** and your own knowledge.

[6 marks]



12

Turn over for next question

Turn over ►



0

3

A student prepared some onion cells.

The student viewed the onion cells using a light microscope.

This is the method used.

1. Cut an onion into pieces using a sharp knife.
2. Peel off a thin layer of onion epidermis from one piece of onion.
3. Place the onion epidermis onto a microscope slide in a single flat layer.
4. Add three drops of iodine solution.
5. Slowly lower a cover slip at an angle onto the onion epidermis.
6. Place the slide on the stage of the microscope.

0

3

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1

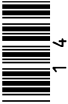
Table 4 shows a risk assessment for this experiment.

Complete Table 4.

[2 marks]

Table 4

Hazard	Risk	Plan to minimise risk
Iodine solution is an irritant	May cause allergic reaction or skin rash	
Sharp knife		



0	3	.	2
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Give a reason for each of the following steps in the method.

[3 marks]

A **thin layer** of onion epidermis is used.

Iodine solution is added to the onion epidermis.

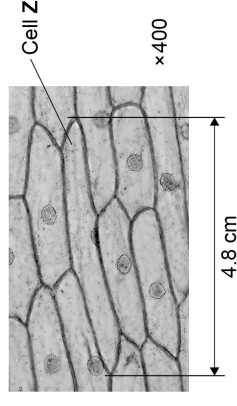
The cover slip is lowered onto the onion epidermis **at an angle**.

Question 3 continues on the next page

Turn over ►

Figure 3 shows what the student saw under the microscope at a magnification of x400.

Figure 3



3	3	0
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The length of cell Z in Figure 3 is 4.8 cm.

Calculate the real length of cell Z.

Give your answer in micrometres (μm).

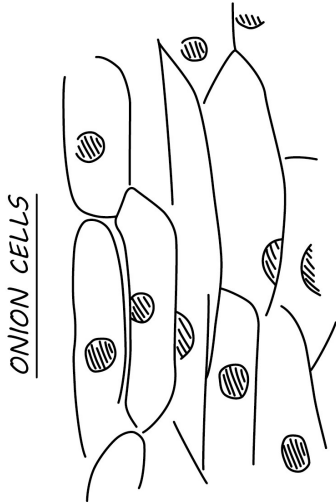
[5 marks]

[illegible]

Real length of cell $Z =$ μm

Figure 4 shows the student's drawing of Figure 3.

Figure 4



03.4 Give two ways the student could improve the drawing in Figure 4. [2 marks]

- 1
- 2

03.5 Onion cells can be seen using an electron microscope. [2 marks]

Give two ways onion cells would look different when seen using an electron microscope.

- 1
- 2

Turn over for the next question

Turn over ▶



04 Plants and animals have many defence responses.

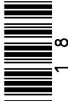
04.1 Table 5 shows some plant defences.

Identify whether each defence is a chemical response or a physical response. [2 marks]

Tick (✓) one box in each row.

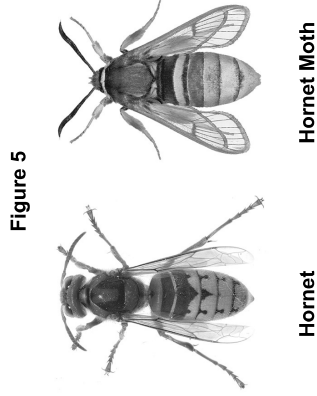
Table 5

Plant defence	Type of response	
	Chemical	Physical
Thick, waxy layer on leaf surface		
Berries that are poisonous		
Bark on trees that falls off		



Mimicry is a mechanical adaptation seen in both plants and animals.

Figure 5 shows two insects.



0	4	.	2
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Hornets are insects that sting other animals and cause pain.

Hornet moths do **not** sting other animals.

Suggest how mimicry helps the **hornet moth** survive.

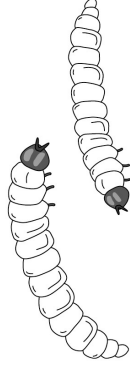
[1 mark]

Question 4 continues on the next page

Turn over ►

Adult hornet moths lay eggs that hatch into larvae.

Figure 6 shows the larvae of a hornet moth.



The larvae of the hornet moth:

- live inside the roots of trees
- use the tree roots as a source of food
- cause damage to the tree roots.

- use the tree roots as a source of food

- cause damage to the tree roots.

Explain why a tree might die if the roots of the tree are damaged.

[6 marks]

04.4

The larvae of the hornet moth form when fertilised eggs divide by mitosis.

Describe how mitosis produces two genetically identical cells.

[4 marks]

04.5

The cells which are first formed from the fertilised eggs of the hornet moth are stem cells.

Name the process by which these stem cells then form specialised cells.

[1 mark]

14

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Water and carbon dioxide are exchanged between leaves and the atmosphere through pores called stomata.

05

Name the cells that control the opening and closing of the stomata.

05.1

[1 mark]

Water moves through a plant in the transpiration stream.

Describe **two** differences between the transpiration stream and translocation.

05.2

[2 marks]

1

2

Which environmental conditions would cause the rate of transpiration to be greatest in a plant?

05.3

[1 mark]

Tick (✓) **one** box.

Cold with low humidity

☐

Cold with high humidity

☐

Warm with low humidity

☐

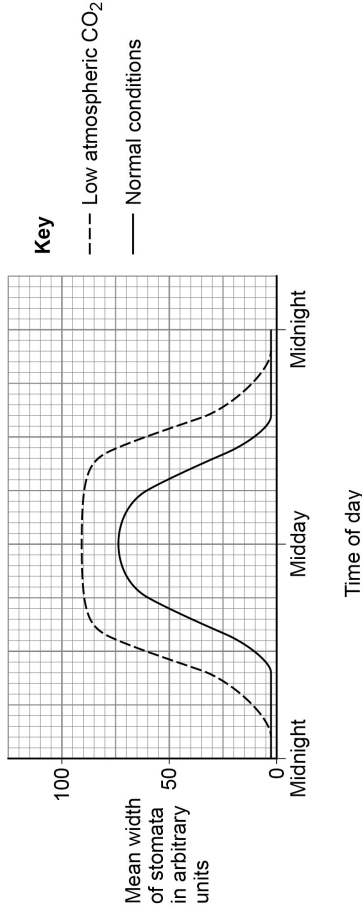
Warm with high humidity

☐

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Figure 7 shows information about the mean width of the stomata in a plant.

Figure 7



05.4

The changes in the mean width of the stomata in **normal conditions** are an advantage to the plant.

Explain how.

[4 marks]



0

5

.

5

 The changes in the mean width of the stomata in low atmospheric carbon dioxide are different from the changes in normal conditions.

Explain how the difference helps the plant to survive in low atmospheric carbon dioxide.

[2 marks]

Turn over for the next question

10

Turn over ▶



0

6

 Table 6 shows information about five different organisms.

Table 6

Organism	Surface area in m ²	Volume in m ³	Surface area to volume ratio
A	6.04×10^{-8}	1.65×10^{-12}	36606:1
B	3.21×10^{-3}	1.25×10^{-6}	2568:1
C	9.96×10^{-3}	1.35×10^{-4}	X:1
D	4.61×10^{-1}	1.57×10^{-2}	29:1
E	1.99×10^1	6.12×10^0	3:1

0

6

.

1

 Calculate value X in Table 6.

Give your answer to the nearest whole number.

[3 marks]

X (nearest whole number) = _____

0

6

.

2

 What is the relationship between the size of an organism and its surface area to volume ratio?

Use Table 6.

[1 mark]



0	6	.	3
---	---	---	---

 Organism **B** exchanges gases with the environment directly through its skin.
Organism **D** exchanges gases with the environment using its respiratory system.

Explain why organism **D** requires a respiratory system, but organism **B** does not require a respiratory system.

[2 marks]

Question 6 continues on the next page

Turn over ►



Table 6 is repeated below.

Table 6

Organism	Surface area in m ²	Volume in m ³	Surface area to volume ratio
A	6.04 × 10 ⁻⁸	1.65 × 10 ⁻¹²	36606:1
B	3.21 × 10 ⁻³	1.25 × 10 ⁻⁶	2568:1
C	9.96 × 10 ⁻³	1.35 × 10 ⁻⁴	X:1
D	4.61 × 10 ⁻¹	1.57 × 10 ⁻²	29:1
E	1.99 × 10 ¹	6.12 × 10 ⁰	3:1

Table 7 shows information about organism **D** and organism **E**.

Table 7

Organism	Metabolic rate in arbitrary units
D	890
E	75



06.4

Organisms **D** and **E** both keep a constant body temperature (warm-blooded).

Explain why the metabolic rate of organism **D** is greater than the metabolic rate of organism **E**.

Use information from **Table 6** and **Table 7**.

[4 marks]

Question 6 continues on the next page

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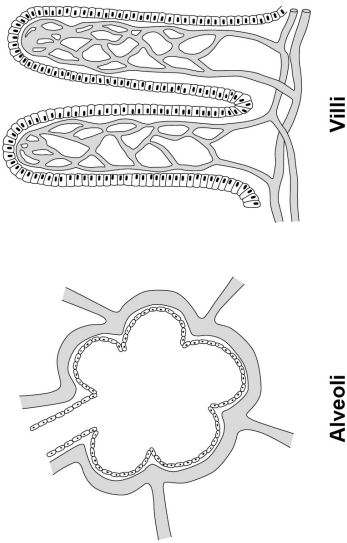


06.5

Organism **D** and organism **E** both have alveoli in the lungs and villi in the small intestine.

Figure 8 shows some alveoli and some villi.

Figure 8



Describe how the alveoli and the villi are adapted to increase absorption.

[4 marks]



Turn over for the next question

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0 7 Human immunodeficiency virus (HIV) is a pathogen.

0 7 . 1 Give **one** way HIV can spread from one person to another person.

[1 mark]

Table 8 shows information about new cases of HIV diagnosed in the UK.

Table 8

Year	Number of new HIV cases in women	Number of new HIV cases in men
2010	376	2266
2012	361	2310
2014	397	2370
2016	298	1886
2018	242	1288

0 7 . 2 Describe the trends shown in **Table 8** between 2010 and 2018.

[2 marks]

0 7 . 3 Suggest **one** reason for the change in the number of new HIV cases between 2014 and 2018.

[1 mark]



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07.4

Calculate the ratio of new cases of HIV in women to new cases of HIV in men in 2018.
Give your answer to 3 significant figures.

[3 marks]

Ratio (3 significant figures) = _____ : 1

07.5

In the UK population the total number of women is greater than the total number of men.
The data in **Table 8** is used to compare the proportions of new cases of HIV in the population for men and women.
Suggest how the data could be presented differently so that a more valid comparison can be made.

[1 mark]

Question 7 continues on the next page

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07.6

Scientists have been working to produce a vaccine for HIV for many years.
Explain how a vaccine for HIV could work to prevent a person developing HIV infection.

[4 marks]

A person with late stage HIV infection has AIDS.

Scientists have produced monoclonal antibodies for HIV.
The monoclonal antibodies can prevent a person infected with HIV developing AIDS.

07.7

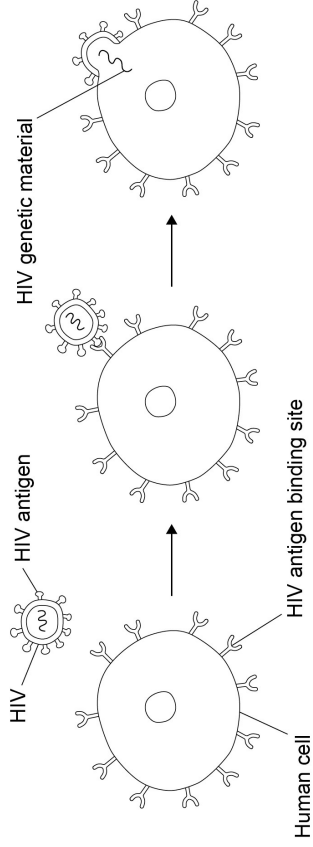
Describe how the monoclonal antibody for HIV can be produced.

[4 marks]



07.8 Figure 9 shows how HIV enters a human cell.

Figure 9



Suggest how the monoclonal antibody for HIV helps to prevent a person infected with HIV developing AIDS.

Use information from Figure 9.

[3 marks]

19

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

Question number	
	Additional page, if required. Write the question numbers in the left-hand margin.

There are no questions printed on this page

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GCSE
BIOLOGY
8461/1H
Paper 1 Higher Tier
Mark scheme
June 2022

Version: 1.0 Final Mark Scheme



Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	nucleus	must be in this order allow chromosomes allow plasmid	1	AO1 4.1.1.1 4.1.1.2
	(site of aerobic) respiration	allow makes ATP or releases energy do not accept produces / makes / creates energy do not accept anaerobic respiration	1	
	(cell) membrane		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	photosynthesis	allow produce glucose / sugar allow to absorb (sun) light ignore contains chlorophyll	1	AO1 4.1.1.2 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	root (hair)	allow xylem / phloem / epidermis / meristem	1	AO1 4.1.1.3 4.2.3.1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	concentration of salt solution		1	AO1 4.1.3.2 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	to make sure only the potato mass was measured or if water / solution / liquid was left on (the potato), the mass would be higher / affected	allow (to) remove excess water / solution / liquid do not accept if water / solution / liquid was left on (potato) the mass would be lower ignore to remove water / solution / liquid on the outside / surface (of potato)	1	AO2 4.1.3.2 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	$\frac{0.2}{2.5} \times 100$ 8(%)	allow $\frac{2.7 - 2.5}{2.5} \times 100$ if no other mark awarded allow 1 mark for $\frac{2.5 - 2.7}{2.5} \times 100 = -8 (\%)$	1	AO2 4.1.3.2 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7 Mark with 01.8	correct scale and axis labelled (concentration (of salt solution) in <u>mol/dm³</u>) all points plotted correctly	max 3 marks for bar chart scale must take up at least 50% of grid allow a tolerance of $\pm \frac{1}{2}$ small square allow 3 or 4 correct plots for 1 mark	1	AO2 4.1.3.2 RPA3
	curved line of best fit	ignore line extended beyond 0.4 mol/dm ³ ignore line joined point to point with straight lines	2	
			1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8 Mark with 01.7	correct answer from their line drawn on Figure 1	allow a tolerance of $\pm \frac{1}{2}$ small square ignore line joined point to point with straight lines if a line of best fit is drawn if no line of best fit is drawn, allow an answer in the range 0.31 – 0.33 (mol/dm ³)	1	AO2 4.1.3.2 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	<u>water</u> moves out of cells / potato	allow 'pieces' for potato throughout	1	AO2 4.1.3.2 RPA3
	by osmosis	allow by diffusion through a partially / selectively / semi permeable membrane	1	
	(because) the solution in the cells / potato is less concentrated than outside or (because) the solution in the cells / potato is more dilute than outside	allow (because) the solution outside the cells / potato is more concentrated than inside allow (because) the solution outside the cells / potato is less dilute than inside allow correct references to <u>water</u> concentration / <u>potential</u> ignore reference to amount of water or salt do not accept water moves from an area of high (solute) concentration to an area of low (solute) concentration	1	
Total Question 1			17	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(cell) wall or (large / permanent) vacuole	ignore cellulose	1	AO3 4.1.1.1 4.1.1.2
02.2	rose black spot		1	AO1 4.3.1.4
02.3	$\frac{24 \times 60}{90}$ or $\frac{24}{1.5}$ 16	$\frac{1440}{90}$ allow do not accept if a unit is given	1	AO2 4.1.1.6 4.1.1.1
02.4	stomach		1	AO1 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	biuret reagent		1	AO1 4.2.2.1 RPA4

Question	Answers	Mark	AO / Spec. Ref.
02.6	Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5-6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3-4	AO2
	Level 1: Relevant points are made. They are not logically linked.	1-2	AO1
	No relevant content.	0	4.2.2.1 4.2.2.4 4.2.2.5 4.2.2.6
	Indicative content		
	- meat-free burgers contain more fibre - aids digestion or prevents constipation - meat burgers contain more protein - for growth - meat burgers contain more fat - can cause CHD or heart attack or narrowing of arteries - may lead to needing a stent - may lead to obesity - obesity is a risk factor for (type 2) diabetes - meat burgers contain more cholesterol - can cause narrowing of arteries or CHD or heart attack - may lead to needing a stent - may need to take statins - both burgers have similar amounts of carbohydrate - good for providing energy - no information on vitamins / minerals provided for either burger - meat burgers require animals to be farmed - increase in methane in atmosphere (methane) contributes to global warming - meat burgers require animals to be slaughtered - ethical issues - some people won't eat meat-free burgers (because) some people don't like the idea of eating fungus (because) some people prefer the taste of meat For Level 2, comparisons and linked reasons using own knowledge are required.		

Total Question 2	12
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Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.									
03.1	<table><tr><th>Hazard</th><th>Risk</th><th>Plan to minimise risk</th></tr><tr><td>Iodine solution is an irritant</td><td>May cause allergic reaction or skin rash</td><td>wash skin immediately (after contact) or wear gloves or clean up spills allow method to prevent spills e.g. use a dropper bottle ignore do not spill</td></tr><tr><td>Sharp knife</td><td>may cut you / someone / skin</td><td>cut away from the body or cut on a chopping board or keep fingers away from blade (when cutting) allow description of how to carry knife safely ignore use a blunt knife</td></tr></table>	Hazard	Risk	Plan to minimise risk	Iodine solution is an irritant	May cause allergic reaction or skin rash	wash skin immediately (after contact) or wear gloves or clean up spills allow method to prevent spills e.g. use a dropper bottle ignore do not spill	Sharp knife	may cut you / someone / skin	cut away from the body or cut on a chopping board or keep fingers away from blade (when cutting) allow description of how to carry knife safely ignore use a blunt knife	1 1		AO3 4.1.1.5 RPA1
Hazard	Risk	Plan to minimise risk											
Iodine solution is an irritant	May cause allergic reaction or skin rash	wash skin immediately (after contact) or wear gloves or clean up spills allow method to prevent spills e.g. use a dropper bottle ignore do not spill											
Sharp knife	may cut you / someone / skin	cut away from the body or cut on a chopping board or keep fingers away from blade (when cutting) allow description of how to carry knife safely ignore use a blunt knife											
1 mark for each correct row													

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	thin layer (to) help see individual cells iodine solution (to) stain / see the parts of the cell at an angle (to) prevent / reduce air bubbles	allow so light can penetrate allow visible named sub-cellular structures e.g. nucleus, cytoplasm, cell wall, starch grains ignore chloroplast ignore (to) stain the cell	1 1 1	AO2 4.1.1.5 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	$\frac{\text{recall of equation}}{\text{magnification =}} \frac{\text{size of image}}{\text{size of real object}}$	allow magnification = $\frac{\text{length of real object}}{\text{length of image}}$ ignore use of equation triangle	1	AO1
	$\frac{\text{rearrangement of equation}}{\text{size of real object =}} \frac{\text{size of image}}{\text{magnification}}$	allow length of real object = $\frac{\text{length of image}}{\text{magnification}}$ allow recall and rearrangement of equation implied at any stage	1	AO2
	$\frac{\text{substitution}}{4.8} \frac{}{400}$	allow substitution of incorrectly converted value	1	AO2
	0.012 (cm)	allow answer using incorrectly converted value	1	AO2
	$\frac{\text{conversion}}{120 (\mu\text{m})}$	allow conversion to μm at any stage	1	AO2
				4.1.1.5 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	any two from: - include magnification / scale - use continuous lines - or ensure no gaps in lines - do not draw overlapping cells - draw (wider) cell walls - do not shade - draw all the cells present - draw correct cell shapes - do not have gaps between cells - draw nuclei in correct location - label cell part(s)	ignore make it neater allow do not colour allow label named cell part(s)	2	AO3 4.1.1.2 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	(would) look more magnified / bigger (cell would) have more detail or (would) be at a higher resolution (could) see more sub-cellular structures or sub-cellular structures seen in detail	ignore reference to zoom allow correct examples of sub-cellular structures such as ribosomes, mitochondria, cell membrane ignore chloroplast allow (could) be in 3D allow would be in black and white	1 	AO1 4.1.1.5

Total Question 3	14
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Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	Thick, waxy layer on leaf surface Berries that are poisonous Bark on trees that falls off	✓ ✓ ✓	2	AO1 4.3.3.2
all three rows correct = 2 marks two rows correct = 1 mark one row correct = 0 marks				

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	(it looks like the hornet so) predators / animals are tricked / deceived (by the colouring) and so avoid eating it	allow (it looks like the hornet so) predators / animals are warned off and so avoid eating it allow correctly named predators eg birds	1	AO2 4.3.3.2

Question	Answers	Mark	AO / Spec. Ref.
04.3	Level 3: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2 4.2.3.1 4.2.3.2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	4.4.1.1 4.4.1.3 4.3.3.1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content - less absorption of water - less water so lower rate of photosynthesis - so less glucose produced - for respiration / energy release - so less cellulose produced so fewer cells walls / cells made - so fewer amino acids produced to make new proteins - cells lose turgidity - less absorption of (named) ions / minerals - fewer nitrates so fewer proteins made for growth - fewer magnesium ions so less chlorophyll produced - so lower rate of photosynthesis - damage to phloem - less transport of sugars to root cells - for respiration / energy release - damage to xylem - less water transported (to cells) - fewer nitrates reach cells - so fewer proteins made for growth - fewer magnesium ions reach cells - so less chlorophyll produced - less magnesium / chlorophyll so lower rate of photosynthesis - less anchorage		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	genetic material / DNA / chromosomes is doubled / replicated / copied / duplicated		1	AO1 4.1.2.2
	the (replicated) chromosomes are pulled / moved apart	the (replicated) chromosomes are separated	1	
	cytoplasm divides into two (cells) or cell membrane divides to form two cells	allow two new nuclei form allow the nucleus divides (into two)	1	
	the set of chromosomes in each new cell are identical (to one another)	allow each new cell has the same set of DNA / alleles / genes (as the other)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	differentiation	ignore specialisation	1	AO1 4.1.2.3 4.1.1.4

Total Question 4	14
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Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	guard (cells)		1	AO1 4.2.3.2 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	any two from: - transpiration (stream) involves xylem and translocation involves phloem - transpiration (stream) transports water (and minerals / ions) and translocation transports (dissolved) sugars - transpiration (stream) moves substances upwards and translocation moves substances upwards and downwards	allow transpiration (stream) involves dead cells and translocation involves living cells allow transpiration (stream) transports water (and minerals / ions) and translocation transports (dissolved) sucrose ignore glucose / ions / minerals in translocation allow transpiration (stream) moves substances unidirectionally and translocation moves substances bidirectionally allow transpiration (stream) does not require energy (to move substances) and translocation does (require energy to move substances)	2	AO1 4.2.3.1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	warm with low humidity		1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	stomata (almost) closed at (mid)night because there is no / less light for photosynthesis	ignore values for time and width ignore dark for no / less light	1	AO3 4.2.3.2 4.4.1.1 4.4.1.2
	(closing stomata) reduces / prevents water loss		1	
	stomata open wide(st) at midday as maximum light intensity for photosynthesis	allow stomata open <u>wider</u> as light intensity increases throughout the morning for photosynthesis	1	
	(stomata open wide) to take in most / more carbon dioxide for photosynthesis	ignore (stomata open) to take in carbon dioxide unqualified	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	stomata are open wider and for more time	allow descriptions of the area of open stomata for width	1	AO3 4.2.3.2 4.4.1.1 4.4.1.2
	(so allows plant) to take in more carbon dioxide for photosynthesis	allow (so allows) plant to take in as much carbon dioxide as in normal conditions for photosynthesis	1	

Total Question 5	10
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Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	9.96×10^{-3}	if no answer in answer space allow answer in Table 6	1	AO2 4.1.3.1
	$\frac{1.35 \times 10^{-4}}{0.00996}$			
	73.77 ...	allow 0.000135	1	
	74 (:1)	allow a correctly derived whole number from an incorrect calculation do not accept if unit is given	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	as size increases, (surface area to volume) ratio decreases	allow they are inversely proportional or they are negatively correlated allow as one increases, the other decreases allow as size decreases, (surface area to volume) ratio increases	1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	D has a smaller surface area to volume ratio (than B) (so) <u>diffusion</u> distance is too large (to meet demands of cells / organism)	allow converse for B throughout	1	AO3
		allow (so) <u>diffusion</u> takes too long (to meet demands of cells / organism)	1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	D has a larger surface area to volume ratio and so will lose heat more quickly (per unit volume than E)	allow converse for E throughout allow D has a larger surface area to volume ratio and so temperature of D will drop more quickly ignore E loses more heat (overall)	1	AO3
	(D) requires greater rate of respiration		1	AO2
	(as) respiration is a (large) part of metabolism		1	AO2
	(so) need to generate more <u>heat</u> (to keep itself warm)	allow (so) needs to release more <u>heat</u> (to keep itself warm) do not accept energy produced / made / created	1	4.1.3.1 4.4.2.1 4.4.2.3

Question	Answers	Mark	AO / Spec. Ref.
06.5	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO1 4.1.3.1 4.1.3.3 4.2.2.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	
	No relevant content	0	
	Indicative content both have a large surface area - to maximise <u>diffusion</u> both have thin walls or have walls that are one cell thick - to reduce diffusion distance / time both are in close proximity to blood supply - to reduce diffusion distance / time both have a good blood supply or both have a capillary network - to maintain concentration gradient - villi have microvilli - to (further) increase surface area - cells of villi contain many mitochondria - for active transport For Level 2 reference to functions of structural details of both alveoli and villi is required.		
Total Question 6		14	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	any one from: - sexual contact / intercourse - exchange of body fluids	allow intercourse unqualified ignore kissing allow example of exchange such as (drug) users sharing needles or blood transfusion or passage from mother to foetus in uterus	1	AO1 4.3.1.1 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	(number of cases) in women decreases then increases, then decreases (number of cases) in men increases then decreases	ignore use of figures allow total numbers (of men and women together) increase then decrease ignore reference to differences between men and women if no other marks awarded allow overall trend decreases in both for 1 mark	1 1	AO3 4.3.1.1 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	any one from: - better education (into prevention of spread of HIV) - condoms more widely available or condoms easier to source or condoms cheaper - new / better drugs (to prevent HIV infection / spread) - better / more testing / identification (of people with HIV)	allow increased awareness about HIV ignore contraception / protection unqualified allow PrEP / anti-retrovirals stop the virus being passed on ignore new treatments do not accept antibiotics allow less promiscuity ignore vaccination	1	AO3 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	$\frac{242}{1288}$ 0.1878... 0.188 (:1)	 allow a rounded answer allow a correctly rounded answer from student's incorrect division using numbers from Table 8 do not accept if a unit is given	1 1 1	AO2 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.8	monoclonal antibody is complementary / specific to HIV antigen	allow 'the virus' for HIV throughout	1	AO3 4.3.2.1 4.3.2.2
	monoclonal antibodies attach to (all the) HIV antigens	allow correct description of complementarity		
	(so) HIV cannot bind to (human) cell or (so) HIV genetic material cannot enter (human) cell	allow white blood cells or phagocytes identify (monoclonal) antibodies and engulf / destroy (antibody bound) HIV		
		alternative route monoclonal antibody is complementary / specific to HIV antigen (1) monoclonal antibody with (anti-retroviral) drug attached attaches to the HIV antigens (1) drug destroys the virus or drug destroys genetic material (1)		
Total Question 7			19	