

Name _____



Triple Science

Foundation

Biology: Paper 1

Please write clearly in block capitals.

Centre number Candidate number

Surname

Forename(s)

Candidate signature

GCSE BIOLOGY

Foundation Tier Paper 1F

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

Materials

For this paper you must have:

- a ruler
- a scientific calculator.

Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

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

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



IB/M/Jun19/E16

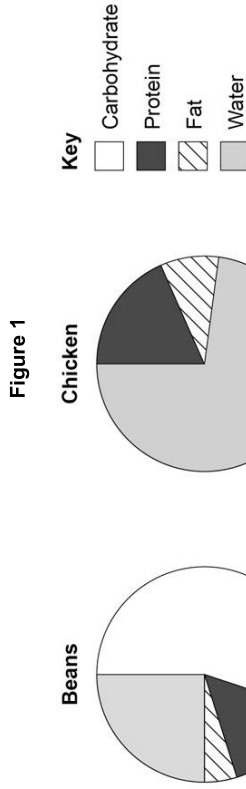
8461/1F

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

0 1

Many foods contain carbohydrates.

Figure 1 shows information about four different foods.



Which food contains the highest percentage of carbohydrate?

0 1 . 1

[1 mark]

Tick (✓) **one** box.

Beans ☐

Chicken ☐

Orange ☐

Rice ☐



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0

1

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2

 Estimate the percentage of water found in beans. [1 mark]

Percentage = _____ %

0

1

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3

 Look at **Figure 1**.
Why would eating only beans provide a more balanced diet than eating only chicken? [1 mark]

0

1

.

4

 Sugars are produced when enzymes break down starch.
What is the name of the enzyme which breaks down starch to produce sugars? [1 mark]
Tick (✓) **one** box.

- Amylase

☐
- Bile

☐
- Lipase

☐
- Protease

☐

0

1

.

5

 Which chemical could be used to test for glucose? [1 mark]
Tick (✓) **one** box.

- Benedict's reagent

☐
- Biuret reagent

☐
- Iodine solution

☐
- Sulfuric acid

☐

Turn over ►



0

1

.

6

 What colour change would be seen in a positive test for glucose? [1 mark]

From blue to _____.

0

1

.

7

 People with diabetes have difficulty controlling the concentration of glucose in their blood.
The blood of four people was tested.

Table 1 shows the results.

Table 1

Person	Concentration of glucose in blood in arbitrary units
A	4.2
B	6.9
C	7.1
D	5.1

Table 2 shows the information used to help decide if a person has diabetes.

Table 2

Concentration of glucose in blood in arbitrary units	Conclusion
<5.6	No diabetes
5.6 to 7.0	Mild diabetes
>7.0	Severe diabetes

Which person has severe diabetes?

Tick (✓) **one** box.

- A

☐
- B

☐
- C

☐
- D

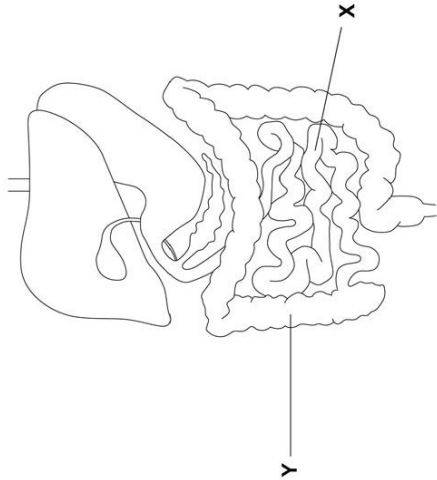
☐

[1 mark]



Figure 2 shows part of the human digestive system.

Figure 2



Glucose is absorbed into the bloodstream in part X.

Name part X.

[1 mark]

0 1 . 8

Complete the sentences.

Choose answers from the box.

[2 marks]

active transport	digestion	excretion
osmosis	respiration	

Some glucose is absorbed into the bloodstream against the concentration gradient by the process of _____.

Water moves out of part Y and into the bloodstream by the process of _____.

10

Turn over ►



An animal called an axolotl lives in water.

Figure 3 shows an axolotl.

Figure 3



Oxygen enters the axolotl's bloodstream through the gills by diffusion.

What is diffusion?

0 2 . 1

[1 mark]

Tick (✓) **one** box.

The movement of particles from a high concentration to a low concentration

☐

The movement of particles from a low concentration to a high concentration

☐

The movement of water from a concentrated solution to a more dilute solution

☐

Describe how **one** feature of the axolotl's gills increases the rate of diffusion of oxygen.

0 2 . 2

[2 marks]

Use information from **Figure 3**.

Feature _____

Description _____



Do not write
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If a gill of an axolotl is removed, stem cells in the damaged area will divide and a new gill will grow.

0

2

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3

Complete the sentence.

Choose the answer from the box.

[1 mark]

adaptation	differentiation	evolution	variation
------------	-----------------	-----------	-----------

When stem cells specialise to produce gill cells, this process is known as _____.

0

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.

4

Complete the sentence.

Choose the answer from the box.

[1 mark]

binary fission	mitosis	mutation
----------------	---------	----------

To grow a new gill the stem cells divide by _____.

0

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5

Which **one** of the following does **not** contain stem cells?

[1 mark]

Tick (✓) **one** box.

Bone marrow	☐
Embryos	☐
Hair	☐
Meristem tissue	☐

Turn over ►



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Axolotls are small animals. Axolotls are used in stem cell research.

0

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6

What are **two** advantages of using axolotls in stem cell research?

[2 marks]

Tick (✓) **two** boxes.

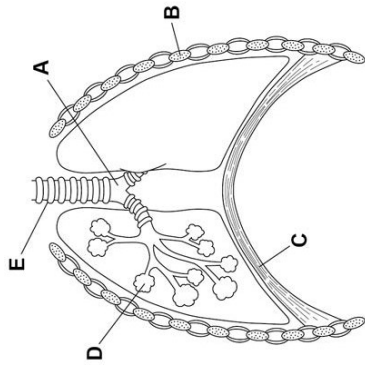
Axolotls are cheap to feed.	☐
Axolotls are easy to breed.	☐
Axolotls are endangered.	☐
Axolotls live in water.	☐
Axolotl research is cruel.	☐



Oxygen uptake in humans takes place in the lungs.

Figure 4 shows the human breathing system.

Figure 4



0 2 . 7 Where does oxygen enter the bloodstream? [1 mark]

Tick (✓) one box.

- A ☐ B ☐ C ☐ D ☐

0 2 . 8 Name part E on Figure 4. [1 mark]

0 2 . 9 Which blood vessel carries blood to the lungs? [1 mark]

Tick (✓) one box.

- Aorta ☐
Pulmonary artery ☐
Vena cava ☐



This question is about leaves.

0 3

Complete the sentences.

0 3 . 1

Choose answers from the box.

[3 marks]

epidermis	phloem	palisade mesophyll
waxy cuticle	xylem	

The layer of cells lining the upper surface and lower surface of a leaf is the _____.

The part of the leaf where most photosynthesis occurs is the _____.

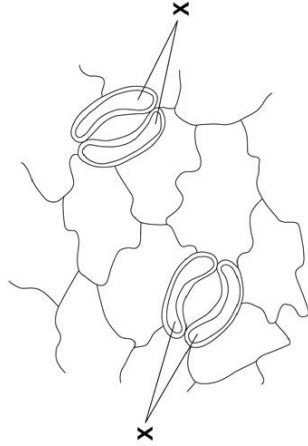
Water is transported to the leaf in the _____.

Water is lost through small openings on the lower surface of plant leaves.

These small openings are called stomata.

Figure 5 shows two stomata on the lower surface of a leaf.

Figure 5



0 3 . 2 The cells labelled **X** control the width of the stomata.

What are the cells labelled **X**?

Tick (✓) **one** box.

- Guard cells ☐
- Mesophyll cells ☐
- Root hair cells ☐
- Stem cells ☐

[1 mark]

0 3 . 3 What is the function of the stomata?

Tick (✓) **one** box.

- To allow light into the leaf ☐
- To let carbon dioxide into the leaf ☐
- To let sugars out of the leaf ☐
- To protect the leaf from pathogens ☐

[1 mark]

0 3 . 4 How is water lost from a leaf?

Tick (✓) **one** box.

- By evaporation ☐
- By respiration ☐
- By translocation ☐

[1 mark]

Turn over ►

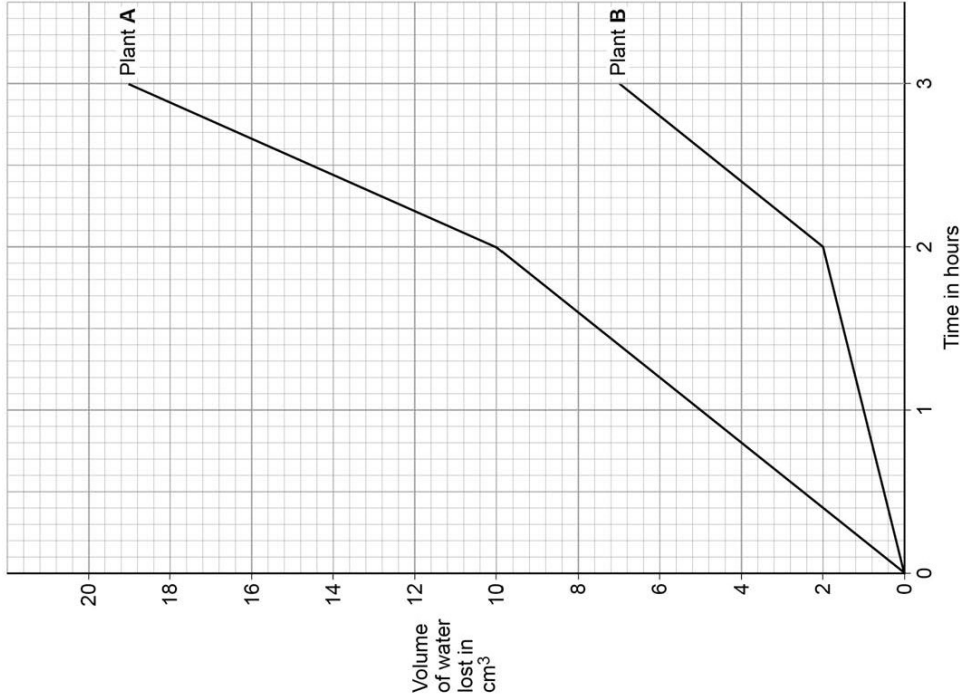


A student investigated the volume of water lost from two plants.

The plants were different species.

Figure 6 shows the student's results.

Figure 6



03.5

Calculate the difference in the volume of water lost by plant **A** compared to plant **B** in the first hour. [2 marks]

Difference in volume = _____ cm³

03.6

What could cause plant **A** to lose water at a faster rate than plant **B**? [1 mark]
Tick (✓) **one** box.

- Plant **A** has fewer stomata per leaf. ☐
- Plant **A** is smaller. ☐
- Plant **A** has more leaves. ☐
- Plant **A** has smaller leaves. ☐

03.7

After the first 2 hours, both plants were moved to a new room. Suggest **one** reason why both plants lost water at a faster rate in the new room. [1 mark]

Question 3 continues on the next page

Turn over ►



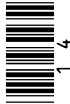
03.8

Some plants have adaptations to stop them from being eaten by animals. Figure 7 shows part of a holly plant.

Figure 7



Describe **one** way the holly plant is adapted to stop it being eaten by animals. [1 mark]



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Turn over ►



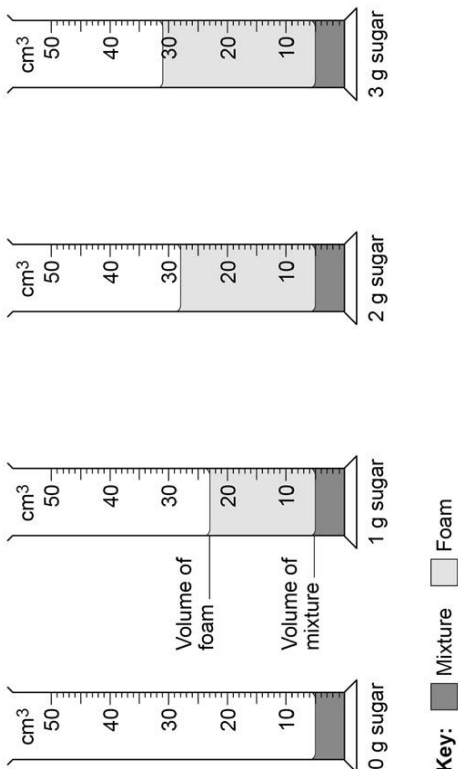
A student investigated respiration in yeast.

This is the method used.

1. Add 5 cm³ of a yeast and water mixture to each measuring cylinder.
2. Add different masses of sugar to each measuring cylinder.
3. Mix the contents of each measuring cylinder gently for 5 seconds.
4. Put the measuring cylinders in a water bath at 25 °C
5. Over the next 20 minutes, record the maximum volume the foam reaches in each measuring cylinder.

Figure 8 shows the student's results.

Figure 8



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0 4 . 1 Which **two** variables did the student control in the method?

Tick (✓) **two** boxes.

- Mass of sugar
- pH of the mixture
- Temperature
- Volume of foam
- Volume of yeast and water

[2 marks]

Table 3 shows the results.

Table 3

Mass of sugar in g	Maximum volume in cm ³
0	5
1	23
2	X
3	31

0 4 . 2 What is value **X** in Table 3?

Use Figure 8.

[1 mark]

X = _____ cm³

Question 4 continues on the next page

Turn over ►



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In the investigation, the yeast respires and releases a gas which causes the foam to rise.

0 4 . 3 Which gas causes the foam to rise? [1 mark]

Tick (✓) **one** box.

- Carbon dioxide
- Hydrogen
- Nitrogen
- Oxygen

0 4 . 4 What conclusion can you make about the relationship between the mass of sugar used and the volume of gas produced? [1 mark]

0 4 . 5 Why was no foam produced in the mixture with 0 g of sugar? [1 mark]

0 4 . 6 Why was the measuring cylinder with 0 g of sugar included in the investigation? [1 mark]



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 The top of the mixture can be covered with a layer of oil after step 3 in the method.
Suggest why the layer of oil stops the yeast respiring aerobically.

[1 mark]

0

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8

 What other substance is produced during **anaerobic** respiration in yeast?

[1 mark]

Tick (✓) **one** box.

- Ethanol
- Hydrochloric acid
- Lactic acid
- Water

9

Turn over for the next question

Turn over ►



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5

 A man has the following symptoms:

- yellow discharge from his penis
- pain when urinating.

0

5

.

1

 The man has a bacterial infection.

What is the most likely cause of the man's symptoms?

[1 mark]

Tick (✓) **one** box.

- Gonorrhoea
- HIV
- Measles
- Salmonella poisoning

0

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.

2

 The man took a full course of antibiotics.

The man's symptoms did **not** improve.

Why did the antibiotics **not** cure the symptoms?

[1 mark]

Tick (✓) **one** box.

- The bacteria are immune to the antibiotics.
- The bacteria are resistant to the antibiotics.
- The man is immune to the antibiotics.
- The man is resistant to the antibiotics.



0 5 . 3 Using a condom can stop the bacteria being passed to another person during sexual intercourse.

Suggest a different way the man could avoid passing the bacteria on to someone else.

[1 mark]

Question 5 continues on the next page

Turn over ►



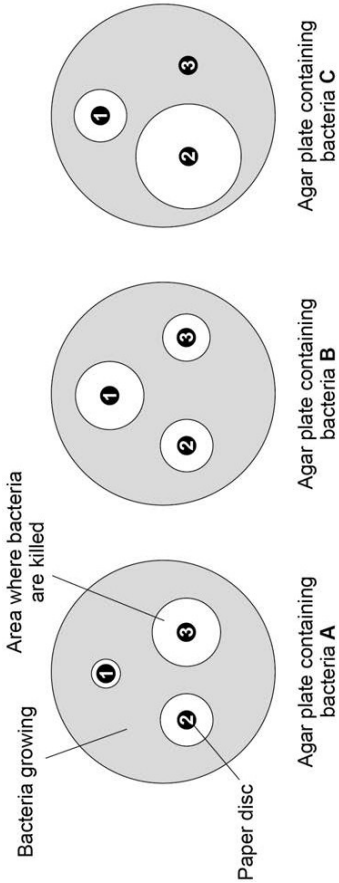
A scientist investigated the effect of three different antibiotics on three different types of bacteria, **A**, **B** and **C**.

This is the method used.

1. Grow bacteria **A** on an agar plate.
2. Put three separate paper discs each containing one of the antibiotics (1, 2 and 3) onto the agar plate.
3. Put the agar plate into an incubator for 48 hours.
4. Repeat steps 1–3 for bacteria **B** and for bacteria **C**.

Figure 9 shows the scientist's results.

Figure 9



Compare the effectiveness of the three antibiotics at killing the different types of bacteria.

[6 marks]

[illegible]

Question 5 continues on the next page

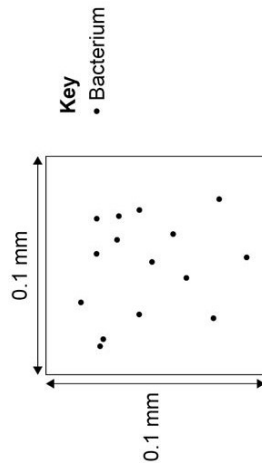
Turn over ►

Milk contains bacteria.

A small volume of raw milk was placed in a counting chamber in a special type of microscope slide.

Figure 10 shows what the counting chamber looked like when viewed using a microscope.

Figure 10



A scientist counted the number of bacteria in four samples of raw milk.

Table 4

Milk sample	Number of bacteria in counting chamber
E	15
F	12
G	13
H	16

Which milk sample is shown in **Figure 10**? **0 5 . 5**

Tick (✓) one box.

Sample E



Sample F

--	--

Sample G

Sample H

[1 mark]

0

5

.

6

 Calculate the mean number of bacteria in the four samples in **Table 4**. **[2 marks]**

Mean number of bacteria =

0

5

.

7

 Calculate the mean number of bacteria per mm³ of milk in the samples.

Complete the following steps.

[3 marks]

Calculate the total area of the counting chamber in **Figure 10**.

Total area of counting chamber = _____ mm²

The depth of the counting chamber is 0.01 mm

Calculate the volume of the counting chamber in **Figure 10**.

Use the equation:

volume = area × depth

Volume of counting chamber = _____ mm³

Calculate the mean number of bacteria per mm³ of milk in the samples.

Use the equation:

mean number of bacteria per mm³ of milk = $\frac{\text{mean number of bacteria from Question 05.6}}{\text{volume of counting chamber}}$

Mean number of bacteria per mm³ of milk = _____

Turn over ►



Milk is heated to reduce the number of bacteria it contains before it is sold for humans to drink.

Milk with more than 20 000 bacteria per cm³ cannot be sold for humans to drink.

Table 5 shows the number of bacteria per cm³ in four different samples of milk.

Table 5

Milk sample	Number of bacteria per cm ³ of milk
P	1.8×10^4
Q	2.2×10^4
R	2.2×10^{-5}
S	1.8×10^3

0

5

.

8

 Which of the milk samples could **not** be sold for humans to drink? **[1 mark]**

Tick (✓) **one** box.

P

Q

R

S

0

5

.

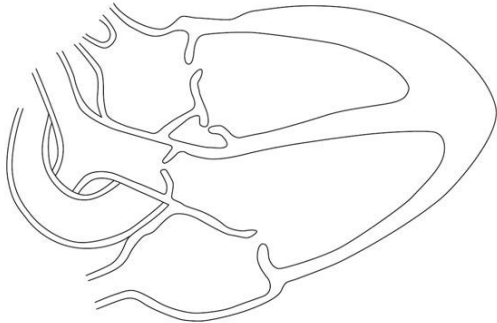
9

 Why should milk sold for humans to drink **not** contain large numbers of bacteria? **[1 mark]**



Figure 11 shows the internal structure of the human heart.

Figure 11



Which organ system is the heart a part of?

[1 mark]

Draw a ring around **one** valve on **Figure 11**.

[1 mark]

What is the function of the valves in the heart?

[1 mark]

Question 6 continues on the next page

Turn over ►

Valves are also found inside some blood vessels.

Which type of blood vessel contains valves?

[1 mark]

Sometimes a valve in the heart can begin to leak.

A leaking heart valve may be replaced with either:

- a mechanical valve
- a biological valve from a pig.

Table 6 shows information about the replacement valves.

Table 6

Mechanical valve	Biological valve from a pig
Made of plastic or metal	Made from living tissue
Can cause the blood to clot around the valve	No risk of blood clotting around the valve
No need for another replacement valve after 5 years	Sometimes another replacement valve is needed after 5 years

Suggest **two** reasons why a patient may choose a mechanical valve and **not** a biological valve from a pig.

[2 marks]

1

2

0 **6** **6** **7** **6**
Suggest **one** reason why a patient may choose a biological valve from a pig and **not** a mechanical valve.

[1 mark]

0 **6** **6** **7** **7**
A person may develop other medical conditions.
Draw **one** line from each medical condition to the correct treatment.

[2 marks]

Medical condition	Treatment
High blood cholesterol	Antibiotics
Irregular heart rate	Artificial pacemaker
	Insulin
	Statins

9

Turn over for the next question

Turn over ►

0 **7** **1**
Figure 12 shows an animal cell viewed using a microscope.

Figure 12



0 **7** **1**
The cell contains a nucleus.

What is the function of the nucleus?

[1 mark]

0 **7** **2**
Name **one** type of cell that does **not** contain a nucleus.

[1 mark]



07.3

 Draw a simple diagram of the cell in **Figure 12**.

Label **two** parts of the cell.

[2 marks]

07.4

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

[1 mark]

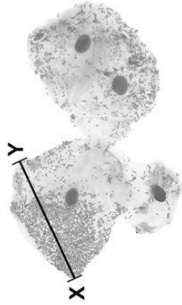
Question 7 continues on the next page

Turn over ►



Figure 13 shows some different cells.

Figure 13



07.5

 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 = $\times$



0	7	.	6
---	---	---	---

The cells shown in **Figure 13** were viewed using a light microscope.

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

1

2

10

Turn over for the next question

Turn over ►

8	0
---	---

Mosquitoes carry a pathogen that causes malaria.

0	8	.	1
---	---	---	---

What type of pathogen causes malaria?

Tick (✓) one box.

A bacterium

A fungus

A protist

A virus

Mosquito nets can help prevent the spread of malaria.

Table 7 shows the results of a study in one area of Africa.

Table 7

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

A newspaper made the following statement:

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

0	8	.	2
---	---	---	---

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

[1 mark]

380.

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

[1 mark]

Table 8

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

4	.	8	0
---	---	---	---

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

[1 mark]

Number of people per 100 000 =

$$58.0$$

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

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

[1 mark]

Turn over ►



680.

Describe how the human body:

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

[6 marks]

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Turn over for the next question

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This question is about photosynthesis.

Complete the word equation for photosynthesis:

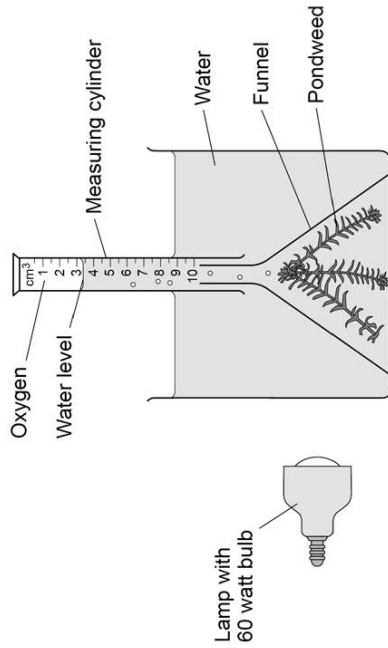
[2 marks]

_____ + _____ → _____ + oxygen

A student investigated photosynthesis using pondweed.

Figure 14 shows the apparatus the student used.

Figure 14



This is the method used.

1. Set up the apparatus as shown in Figure 14.
2. Switch on the lamp.
3. After 20 minutes, record the volume of oxygen collected in the measuring cylinder.
4. Repeat steps 1–3 using bulbs of different power output.



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09.2 What was the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

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

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

[2 marks]

- 1
- 2

Question 9 continues on the next page

Turn over ▶



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Table 9 shows the student's results.

Table 9

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

09.4 Calculate value X in Table 9.

[1 mark]

X = _____ cm³/hour



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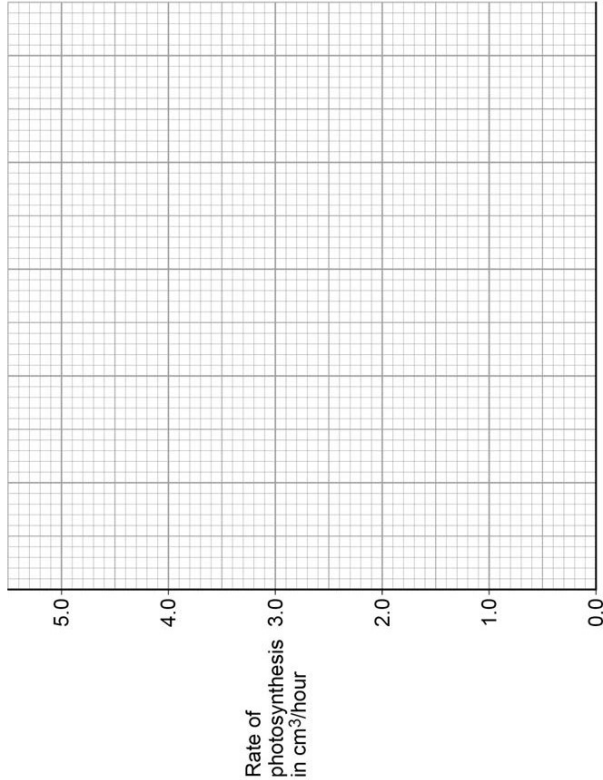
09.5 Complete Figure 15.

[4 marks]

You should:

- label the x-axis
- use a suitable scale
- plot the data from Table 9 and your answer to Question 09.4
- draw a line of best fit.

Figure 15



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

Use Figure 15.

[1 mark]

Rate of photosynthesis at 75 watts = _____ cm³/hour

Turn over ►



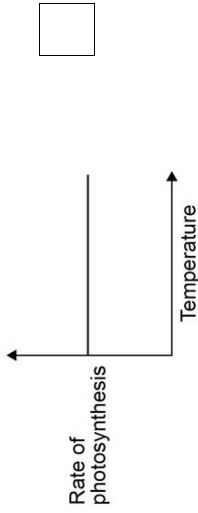
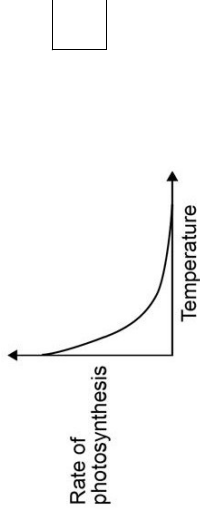
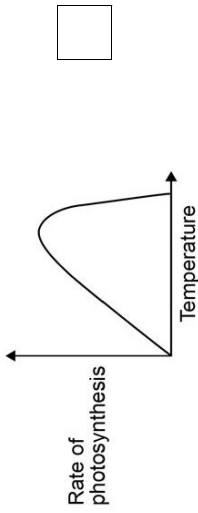
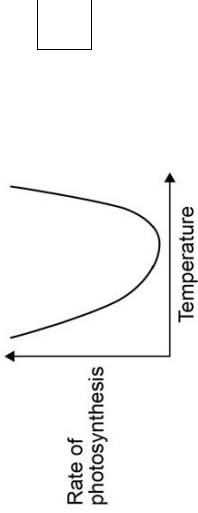
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09.7

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

[1 mark]

Tick (✓) one box.

☐☐☐☐

END OF QUESTIONS



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4 3

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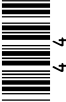
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4 4

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1 9 6 G 8 4 6 1 / 1 F

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	rice		1	4.2.2.1 AO3
01.2	25 (%)	allow an answer between 23 and 27 (%) ignore ¼ / 0.25	1	4.2.2.1 AO2
01.3	(beans) contain all (four) food groups	allow converse for chicken allow chicken contains no / less carbohydrate or beans contain carbohydrate allow beans contain more nutrients ignore references to water / fat / protein	1	4.2.2.1 AO3
01.4	amylase		1	4.2.2.1 AO1
01.5	Benedict's reagent		1	4.2.2.1 AO1
01.6	(brick) red / green / yellow / orange / brown		1	4.2.2.1 AO1
01.7	C		1	4.2.2.1 AO3
01.8	small intestine	allow ileum ignore intestine unqualified do not accept large intestine / duodenum	1	4.1.3.3 4.2.2.1 AO1
01.9	active transport osmosis		1 1	4.1.3.2 4.1.3.3 AO1 AO1
Total			10	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the movement of particles from a high concentration to a low concentration		1	4.1.3.1 AO1
02.2	(gills) have (many) projections (for) large(r) surface / area or (gills) are on the outside of the body (1) for good access to water (1)	allow description of projections allow have lots of / five gills 1	1	4.1.3.1 AO2
02.3	differentiation		1	4.1.2.3 AO1
02.4	mitosis	do not accept meiosis	1	4.1.2.2 AO1
02.5	hair		1	4.1.2.2 4.1.2.3 AO1
02.6	axolotls are cheap to feed axolotls are easy to breed		1 1	4.1.2.3 AO3
02.7	D		1	4.2.2.2 AO1
02.8	trachea	allow windpipe allow cartilage (ring)	1	4.2.2.2 AO1
02.9	pulmonary artery		1	4.2.2.2 AO1
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	epidermis palisade mesophyll xylem	allow palisade / mesophyll	3	4.2.3.2 4.2.3.1 AO1
03.2	guard cells		1	4.2.3.2 4.2.3.1 AO1
03.3	to let carbon dioxide into the leaf		1	4.2.3.2 AO1
03.4	by evaporation		1	4.2.3.2 AO1
03.5	evidence of correct graph readings (5 and 1) 4 (cm ³)	an answer of 4 (cm ³) scores 2 marks allow in range 4.8 to 5.2 and 0.8 to 1.2 allow correct subtraction from their graph readings allow their calculated value from readings in the range 4.6 to 5.4 and 0.6 to 1.4	1 1	4.2.3.2 AO2
03.6	plant A has more leaves		1	4.2.3.2 AO3
03.7	any one from: (the new room was) • windier • warmer • drier / less humid • brighter	answers must be comparative allow sunnier ignore more sun	1	4.2.3.2 AO2

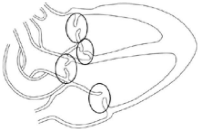
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	any one from: - spikes / points / thorns / sharp - poisonous / toxic - brightly coloured berries - leaves are tough / leathery or leaves are hard to chew	ignore reference to predators eating holly allow unpleasant taste	1	AO2 4.3.3.2
Total			11	

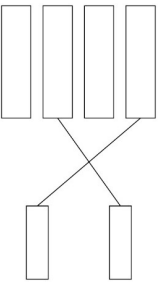
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	temperature volume of yeast and water		1 1	4.4.2.1 AO3
04.2	28		1	4.4.2.1 AO2
04.3	carbon dioxide		1	4.4.2.1 AO2
04.4	the greater the mass of sugar, the greater the volume of foam / gas produced	allow reference to weight / amount of sugar allow reference to amount of foam / gas allow positive correlation ignore names of gases ignore directly proportional	1	4.4.2.1 AO3
04.5	no respiration occurs or sugar / glucose is needed for respiration	ignore no reaction occurs	1	4.4.2.1 AO2
04.6	for comparison / to compare or to check that no other factor / variable is influencing the results or to ensure validity	allow as a control (experiment) allow as a base line do not accept as a control variable allow answers in the context of the investigation e.g. to prove that the results obtained were due to the sugar (and nothing else) ignore fair test / accuracy	1	4.4.2.1 AO2
04.7	(it) stops the oxygen / air getting in / through	ignore (it) stops the oxygen / air getting out ignore gases unqualified	1	4.4.2.1 AO2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	ethanol		1	4.4.2.1 AO1
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	gonorrhoea		1	4.3.1.3 AO1
05.2	the bacteria are resistant to the antibiotics		1	4.3.1.3 AO2
05.3	abstain from sex(ual intercourse) or wash hands after touching penis / urinating / using the toilet	allow abstinence ignore wash hands unqualified	1	4.3.1.1 4.3.1.3 AO2
05.4	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
	Level 1: Relevant features are identified and differences noted.			1–3
	No relevant content			0
	Indicative Content: qualitative statements • 3 works best on A • 1 works best on B • 2 works best on C • 1 is least effective on A • 3 is least effective on B • 3 is least effective or has no effect on C quantitative statements • 1 kills more of B and C compared to A • 2 kills more of C than A / B • 3 kills more of A than B and C • 2 kills the same amount of A and B • 2 and 3 killed similar amounts of B • C are resistant to 3 • only 2 worked well on all of the bacteria • for A, 3 works best, 2 is next and 1 is least effective • for B, 1 works best, 2 is next and 3 is least effective • for C, 2 works best, 1 is next and 3 is least effective			4.1.1.6 AO3 x3 AO2 x3
	for level 2 reference to qualitative and quantitative statements is required			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	sample E		1	4.1.1.6 AO2
05.6	$\frac{15 + 12 + 13 + 16}{4}$ or $\frac{56}{4}$ 14	an answer of 14 scores 2 marks	1	4.1.1.6 AO2
05.7	(area = 0.1×0.1 =) 0.01 (volume = 0.01×0.01 =) 0.0001 (number = $\frac{14}{0.0001}$ =) 140 000	an answer of 140 000 scores 3 marks an incorrect answer for one step does not prevent allocation of marks for subsequent steps allow 1×10^{-2} allow 1×10^{-4} allow ecf from question 05.6 allow 1.4×10^5 do not accept 14×10^4	1 1 1	4.1.1.6 AO2
05.8	Q		1	4.1.1.6 AO2
05.9	(bacteria) could make humans ill or (bacteria) could kill humans or (bacteria) could release toxins	allow reverse argument allow (bacteria) cause infection / disease allow (bacteria) cause appropriately named disease ignore harmful	1	4.3.1.1 AO2
Total			17	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	circulatory / circulation (system)	allow cardiovascular (system) ignore blood (system) ignore cardiorespiratory system	1	4.2.2.2 4.2.1 AO1
06.2	any valve ringed 	allow more than one valve separately ringed	1	4.2.2.2 AO1
06.3	prevent backflow (of blood) or ensure one-way flow	allow correct description of backflow allow maintains (correct) direction of blood	1	4.2.2.2 4.2.2.4 AO1
06.4	vein	allow correctly named veins	1	4.2.2.2 AO1
06.5	any two from: (referring to mechanical valves) • long lasting - or • durable - or • does not break / tear - or • does not wear out • do not need to go into hospital / surgery again • no ethical issues (surrounding use of living / animal tissue) • no risk of rejection • no need for anti-rejection / immunosuppressant drugs • no risk of transmission of disease	allow reliable allow less likely to need a replacement (after 5 years) ignore no need for a replacement	2	4.2.2.4 AO3

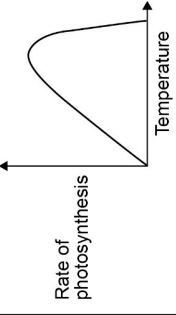
Question	Answers	Extra information	Mark	AO / Spec.Ref.
06.6	no need to take anti-clotting medication	allow can't hear a pig valve allow can get a better fit with a pig valve allow less leaky with a pig valve allow less likely to get a heart attack / stroke ignore will not get blood clots (around the valve)	1	4.2.2.4 AO3
06.7		an additional line from a medical condition negates the mark	2	4.2.2.2 AO1
Total			9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	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
07.2	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
07.3	cell shape is similar to cell in Figure 12 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
07.4	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.
08.5	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	Extra information	Mark	AO / Spec. Ref.
08.6	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	Level 2 response should refer to body defence and the immune system	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			
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	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
09.2	power output of bulb		1	4.4.1.2 AO2
09.3	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
09.4	3.3 (cm ³ /hour)		1	4.4.1.2 AO2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	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 09.4 correct curved line of best fit	1 2 1	4.4.1.2 AO2
09.6	correct answer from their line drawn on Figure 15	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
09.7	Rate of photosynthesis		1	4.4.1.2 AO2
Total			12	

Please write clearly in block capitals.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE

BIOLOGY

F

Foundation Tier

Paper 1F

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 F 0 1

IB/M/Jun21/E24

8461/1F

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

This question is about cells.

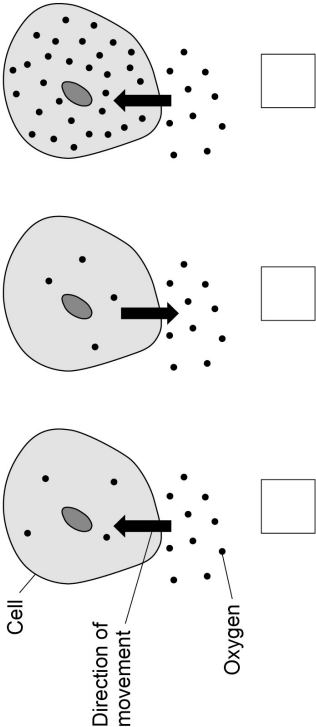
01

Which diagram shows oxygen moving by diffusion?

011

Tick (✓) **one** box.

[1 mark]



Complete the sentences.

012

Choose answers from the box.

[3 marks]

carbon dioxide	chlorophyll	energy
light	mineral ions	water

Plant cells absorb substances from the soil.

Plant cells use osmosis to absorb _____.

Plant cells use active transport to absorb _____.

Active transport moves substances against the concentration gradient and needs _____.

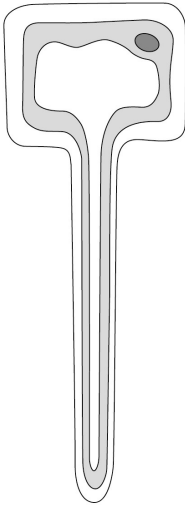


0 2

IB/M/Jun21/8461/1F

Figure 1 shows a specialised cell that absorbs substances from the soil.

Figure 1



013

Name the type of specialised cell in Figure 1.

[1 mark]

014

Describe how the cell in Figure 1 is adapted to increase the absorption of substances from the soil.

[1 mark]

Question 1 continues on the next page

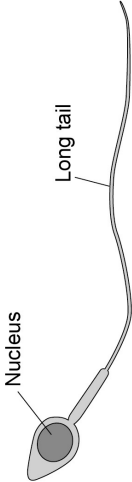
Turn over ▶



A sperm cell is another specialised cell.

Figure 2 shows a sperm cell.

Figure 2



015

Draw **one** line from each feature to how the feature helps the sperm cell carry out its function.

[2 marks]

Feature of sperm cell

How the feature helps

Contains a nucleus

Has a long tail

To break the outer layer of the egg

To help the cell to swim to the egg

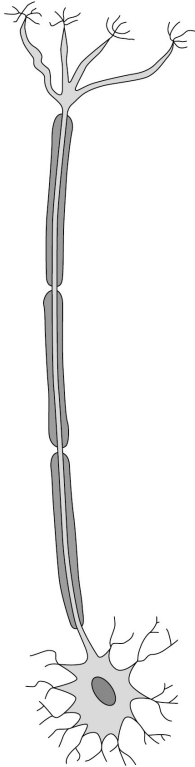
To provide the chromosomes for fertilisation

To release energy



Figure 3 shows another specialised cell.

Figure 3



01.6 Name the type of cell in Figure 3.

Describe one feature of the cell that helps it to carry out its function.

[2 marks]

Name of the cell _____

Feature of the cell _____

10

Turn over for the next question

Turn over ►



02 Viruses cause disease.

02.1 What name is given to microorganisms that cause disease?

Tick (✓) one box.

Pathogens	☐
Predators	☐
Prokaryotes	☐

[1 mark]

02.2 How do viruses cause the symptoms of disease?

Tick (✓) one box.

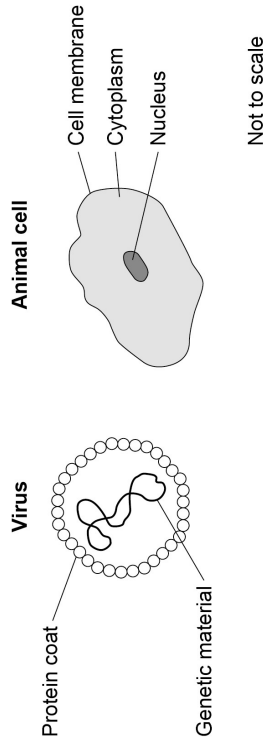
Viruses engulf white blood cells, destroying them.	☐
Viruses produce antibodies that damage tissues.	☐
Viruses reproduce inside cells, damaging them.	☐

[1 mark]



Figure 4 shows a virus and an animal cell.

Figure 4



0 2 . 3 Suggest **one** reason why viruses are **not** classed as cells.

[1 mark]

A vaccine can protect humans from a viral disease.

0 2 . 4 What does the vaccine contain?

[1 mark]

Tick (✓) **one** box.

- A toxic form of a virus ☐
- A weakened form of a virus ☐
- An active form of a virus ☐

Question 2 continues on the next page

Turn over ►

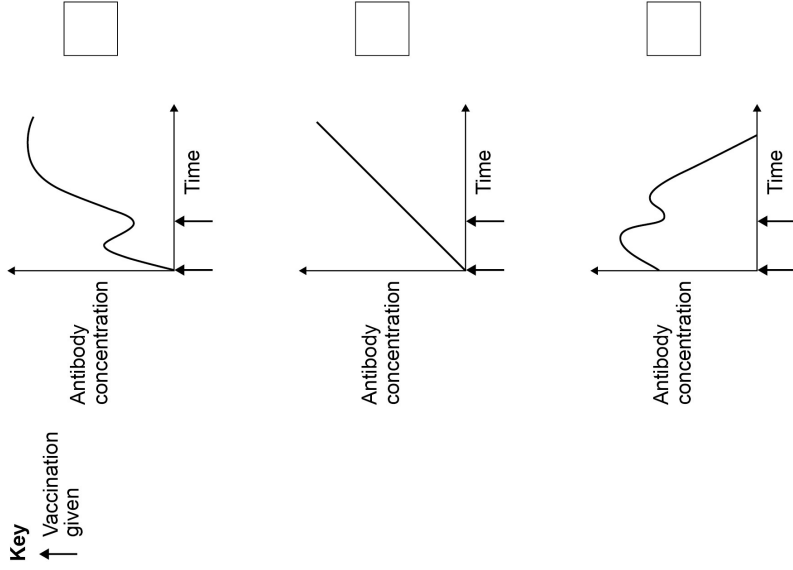
In some cases, a first vaccination needs to be followed by a second vaccination some time later.

0 2 . 5

Which graph shows how the concentration of antibodies in a person's blood changes after the first and second vaccinations?

[1 mark]

Tick (✓) **one** box.



Tobacco mosaic virus (TMV) causes disease in plants.
TMV affects the rate of photosynthesis in plants.

02.6

Which part of a plant shows discolouration caused by TMV?

Tick (✓) **one** box.

Flower	☐
Leaf	☐
Root	☐

[1 mark]

Question 2 continues on the next page

Turn over ▶



Table 1 shows the rate of photosynthesis in four different tobacco plants.

Table 1

Tobacco plant	Level of TMV infection in plant	Rate of photosynthesis in arbitrary units
A	None	15
B	Mild	13
C	Medium	7
D	High	3

02.7

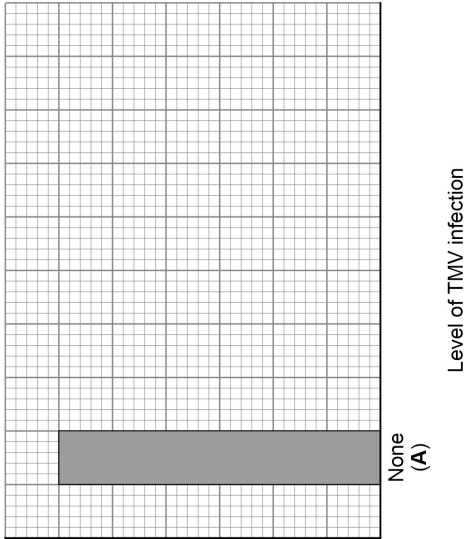
Complete Figure 5.

You should:

- label the y-axis
- add the correct scale to the y-axis
- plot the data from Table 1
- label each bar.

[5 marks]

Figure 5



What conclusion can be made from the data in Table 1?

[1 mark]

Explain why a high level of TMV infection reduces growth in a plant.

[2 marks]

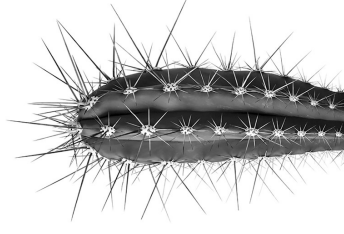
Turn over for the next question

Turn over ►

A cactus is a plant that lives in a dry environment.

Figure 6 shows part of a cactus plant.

Figure 6



Give **one** adaptation shown in **Figure 6** that helps to prevent the cactus from being eaten by animals.

[1 mark]

A plant may produce poisons that make animals unwell.

What is this type of defence mechanism?

Tick (✓) **one** box.

Chemical

1

Mechanical

10

Physical

1

[1 mark]

Turn over ►

Do not write
outside the
box

03.3

 Some desert plants only grow leaves after it has rained.

As soon as the soil dries out, the leaves fall off.

How could the leaves falling off the plant be an advantage to a plant that lives in a dry environment?

Tick (✓) **one** box.

The plant is less likely to reproduce.

The plant will not lose as much water.

The plant will photosynthesise faster.

[1 mark]

03.4

 What causes the green colour in the stem?

[1 mark]

03.5

 What is the advantage to the cactus of having a green stem?

[1 mark]

Question 3 continues on the next page

Turn over ►



Do not write
outside the
box

The stem of a cactus contains many different tissues.

03.6

 What name is given to a group of tissues working together?

[1 mark]

Tick (✓) **one** box.

Organ

Organism

Organ system

03.7

 Name **one** substance transported through the xylem in the stem of the cactus.

[1 mark]

03.8

 Name the tissue that transports dissolved sugars through the stem of the cactus.

[1 mark]



Carbohydrates are needed as part of a balanced diet.

04.1

Which formula shows glucose?

Tick (✓) **one** box.

$C_6H_{12}O_6$	☐
CO_2	☐
H_2O	☐
O_2	☐

[1 mark]

Which type of enzyme breaks down starch?

Tick (✓) **one** box.

Carbohydrase	☐
Lipase	☐
Protease	☐

[1 mark]

Question 4 continues on the next page

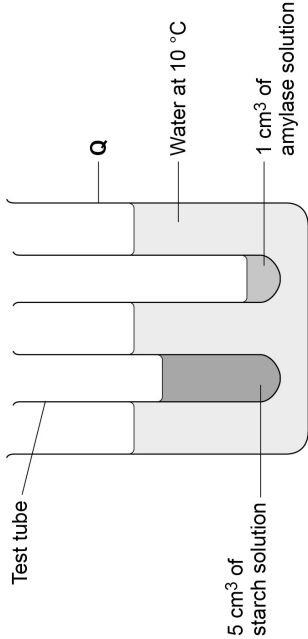
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A student investigated the effect of temperature on the activity of the enzyme amylase.

Figure 7 shows the apparatus used.

Figure 7



This is the method used.

1. Set up the apparatus as shown in **Figure 7**.

2. After 5 minutes, pour the starch solution into the amylase solution and mix.

3. Remove one drop of the amylase-starch solution mixture and place onto a spotting tile.

4. Immediately add two drops of iodine solution to the amylase-starch solution mixture on the spotting tile.

5. Record the colour of the iodine solution added to the amylase-starch solution mixture.

6. Repeat steps 3 to 5 every minute until the iodine solution is yellow-brown.

Name apparatus **Q** in **Figure 7**.

04.3

[1 mark]



Why were the starch solution and the amylase solution left for five minutes before mixing them together?

0

4

.

4

[1 mark]

Tick (✓) **one** box.

- So that both solutions could reach 10 °C

☐
- So that the student could calculate a mean

☐
- So that the student could repeat the investigation

☐
- So that the student had time to draw a table of results

☐

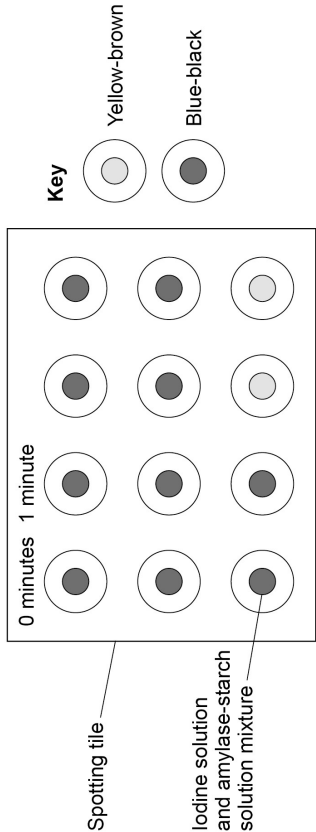
Question 4 continues on the next page

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Figure 8 shows the results.

Figure 8



0

4

.

5

How many minutes did it take until the iodine solution and amylase-starch solution mixture was yellow-brown?

Use Figure 8.

[1 mark]
_____ minutes

0

4

.

6

How could a more accurate time be obtained?

Tick (✓) **one** box.

- Add more iodine solution to the spotting tile.

☐
- Test the mixture with iodine solution every 30 seconds.

☐
- Test the mixture with iodine solution for more time.

☐
- Use two drops of amylase-starch solution mixture in each test.

☐



The student repeated the investigation at five different temperatures.

Table 2 shows the results.

Table 2

Temperature in °C	Time taken until iodine solution and mixture was yellow-brown in minutes
20	5
35	2
50	7
65	12
80	Remained blue-black

Which temperature did the enzyme work quickest at?

[1 mark]

Tick (✓) **one** box.

20 °C

☐

35 °C

☐

50 °C

☐

65 °C

☐

Explain why the iodine solution remained blue-black in the investigation at 80 °C.
[2 marks]

9

Turn over ►



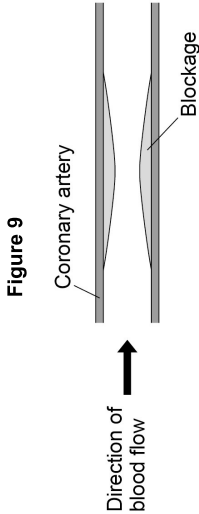
There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED



A high cholesterol concentration in the blood can lead to blockages inside arteries.
The coronary arteries supply blood to the heart muscle.

Figure 9 shows a coronary artery with a blockage.



Why could the blockage in Figure 9 cause cells in the heart to die?

[2 marks]

Question 5 continues on the next page

Turn over ►

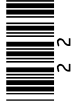
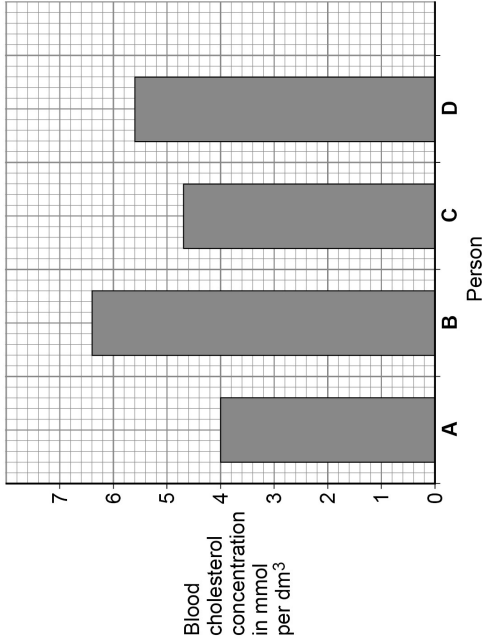
Doctors can measure the concentration of cholesterol in the blood.
Table 3 shows four different blood cholesterol categories.

Table 3

Blood cholesterol concentration in mmol per dm ³	Cholesterol category
<4.6	Low
4.6–5.0	Normal
5.1–6.1	Medium
6.2 and above	High

Figure 10 shows the blood cholesterol concentration of four people.

Figure 10



0 5 . 2 Which person is in the medium cholesterol category?

[1 mark]

Tick (✓) **one** box.

A	☐	B	☐	C	☐	D	☐
---	--------------------------	---	--------------------------	---	--------------------------	---	--------------------------

0 5 . 3 Which person is most at risk of having a heart attack?

[1 mark]

Tick (✓) **one** box.

A	☐	B	☐	C	☐	D	☐
---	--------------------------	---	--------------------------	---	--------------------------	---	--------------------------

0 5 . 4 Give a reason for your answer to Question 05.3.

[1 mark]

0 5 . 5 The blood cholesterol concentration of person **D** is greater than the blood cholesterol concentration of person **A**.

Calculate how many times greater.

Use **Figure 10**.

[2 marks]

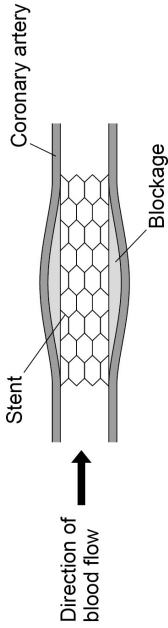
Number of times greater = _____

Question 5 continues on the next page

Turn over ►

Figure 11 shows how a stent can be used to treat a person with a blockage in a coronary artery.

Figure 11



0 5 . 6 Explain how a stent works as a treatment for a person with a blockage in a coronary artery.

[2 marks]

Patients are given anti-clotting drugs after they have a stent fitted.

The drugs help to prevent clots forming in the blood.

0 5 . 7 Which part of the blood starts the blood clotting process?

[1 mark]

Tick (✓) **one** box.

Antibodies	☐
Plasma	☐
Platelets	☐
Red blood cells	☐

The model in **Figure 12** represents the human breathing system.

A teacher said:

“The model does **not** represent the human breathing system very well.”

0

6

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2

 Give **two** reasons why the teacher is correct. **[2 marks]**

- 1

- 2

-

Question 6 continues on the next page

Turn over ►



A scientist investigated the effect of exercise on breathing rate.

This is the method used.

1. Record the breathing rates of 10 male non-smokers at rest.
2. Tell each man to run on a treadmill at the same speed for 8 minutes.
3. Record the breathing rate of each man every 2 minutes.
4. Continue to record the breathing rate of each man for 4 minutes after he stops running.

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3

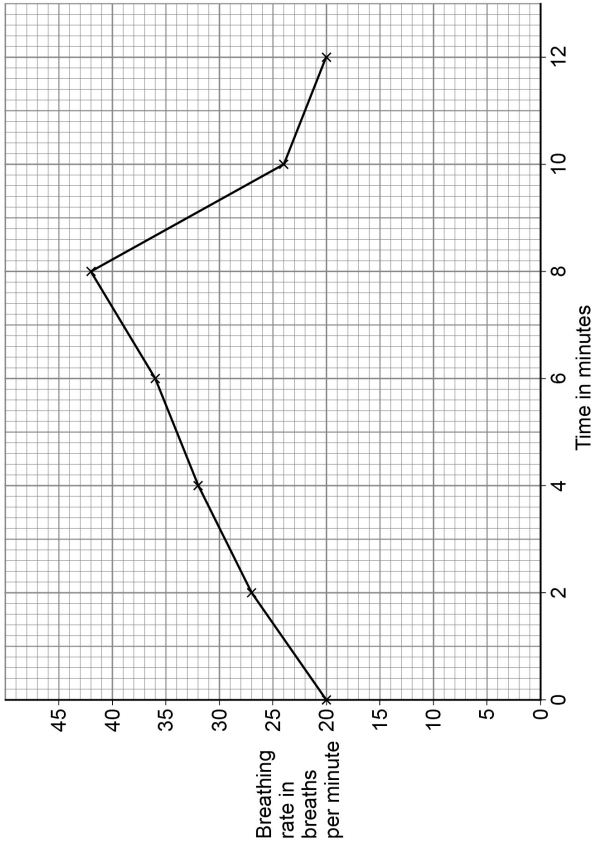
 Give **two** variables the scientist controlled in the investigation. **[2 marks]**

- 1

- 2

Figure 13 shows the data collected from **one** of the men.

Figure 13



Do not write
outside the
box

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4

 Calculate the percentage increase in the man's breathing rate between 0 minutes and 8 minutes.

[3 marks]

Use the equation:

percentage increase = $\frac{(\text{breathing rate at 8 minutes} - \text{breathing rate at 0 minutes})}{\text{breathing rate at 0 minutes}} \times 100$

Percentage increase = _____ %

0

6

.

5

 Explain why the man's breathing rate increased when he was running.

[2 marks]

Question 6 continues on the next page

Turn over ►



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box

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6

 Give **one** measurement that could be taken to show a different effect of exercise on the body.

[1 mark]

Do **not** refer to breathing rate in your answer.

0

6

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7

 The men in the investigation were all non-smokers.

[1 mark]

Give **one** effect that smoking can have on the body.



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

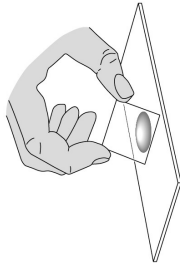
Turn over ►



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

Figure 14 shows the student preparing the cells.

Figure 14



0 7 . 1

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

[2 marks]

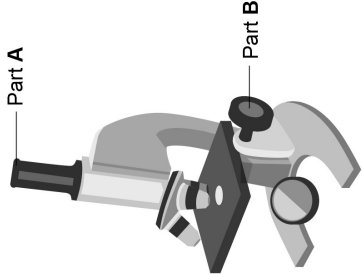
1

2



Figure 15 shows the student's light microscope.

Figure 15



07.2

Name part A.

[1 mark]

07.3

What is the function of part B?

[1 mark]

07.4

The student tried to look at the cells using the microscope.

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

[1 mark]

Question 7 continues on the next page

Turn over ►



07.5

Red blood cells are specialised animal cells.

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

[6 marks]

07.6

When placed into a beaker of water:

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

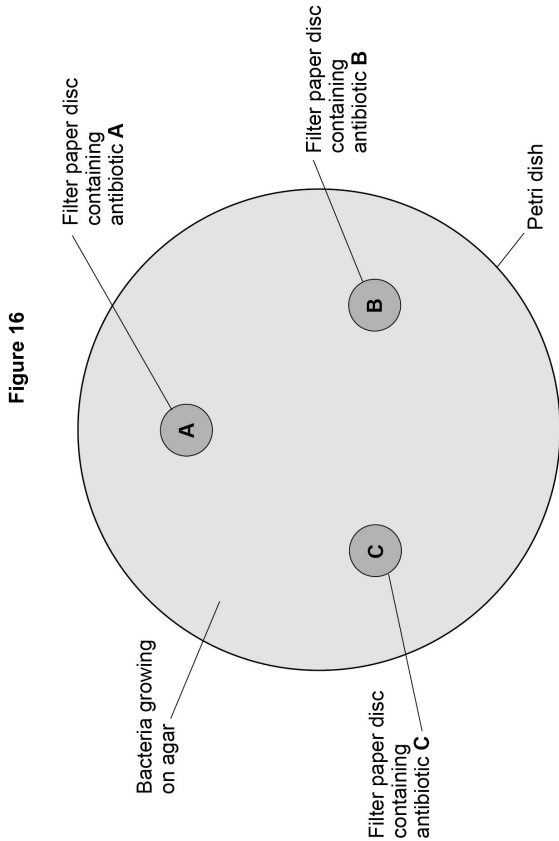
Explain why the red blood cell bursts but the plant cell does **not** burst.

[2 marks]



0 8 A student investigated the effectiveness of three different antibiotics.

Figure 16 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.

0 8 . 1 Describe **two** aseptic techniques the student should have used.

[2 marks]

1 _____

2 _____

Question 8 continues on the next page

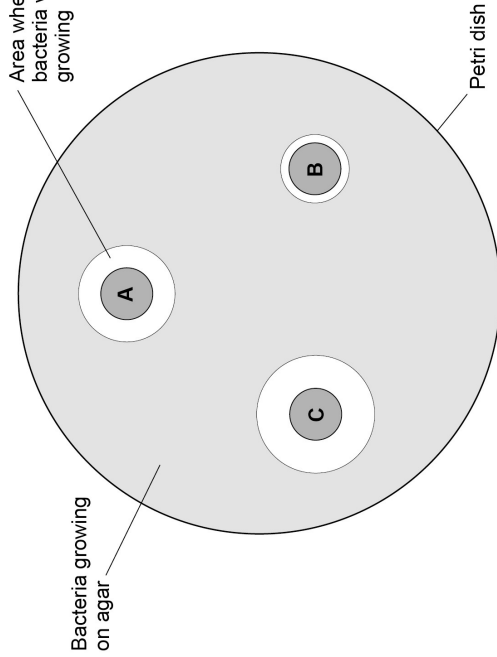
Turn over ▶



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

Figure 17 shows the agar plate after 48 hours.

Figure 17



0 8 . 2 Which antibiotic is the **least** effective?

[1 mark]

Give a reason for your answer.

Least effective antibiotic _____

Reason _____



09.1 Which is the BMI category of person A in Table 4?

[1 mark]

Tick (✓) one box.

Clinically obese

Normal

Obese

Overweight

Underweight

09.2 Calculate value X in Table 4.

09.3

Use the equation:

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

Give your answer to 3 significant figures.

[3 marks]

X = kg/m²

Question 9 continues on the next page

Turn over ▶



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

Table 5 shows information about predicted life expectancy of men after the age of 50.

Table 5

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

09.3 Describe two patterns shown in Table 5 about the effects of BMI category. [2 marks]

1

2



Do not write
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box

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

09.4

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

[2 marks]

09.5

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]

09.6

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.

[2 marks]

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

1

2

11

END OF QUESTIONS



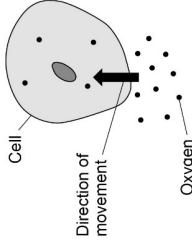
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ANSWER IN THE SPACES PROVIDED



[illegible]

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1			1	AO3 4.1.3.1
01.2	water mineral ions energy	in this order only allow minerals / ions	1 1 1	AO1 4.1.3.2 4.1.3.3 4.2.3.2
01.3	root hair (cell)	ignore root / hair unqualified	1	AO1 4.1.1.3 4.2.3.2
01.4	large surface / area	allow it has a long projection allow the walls are thin allow it has lots of mitochondria	1	AO1 4.1.1.3 4.2.3.2
01.5	Feature of sperm cell Contains a nucleus Has a long tail	How the feature helps To break the outer layer of the egg To help the cell to swim to the egg To provide the chromosomes for fertilisation To release energy	1 1	AO1 4.1.1.3
	do not accept more than one line from a box on the left			



02.7	y-axis labelled rate of photosynthesis in arbitrary units correct scale all bars plotted correctly all bars correctly labelled	1 1 2 1	AO2 4.4.1.1
02.8	as the level of infection (with TMV) increases, (the rate of) photosynthesis decreases	allow as TMV increases, photosynthesis decreases allow (the rate of) photosynthesis decreases as the level of infection (with TMV) increases allow as infection gets worse, photosynthesis decreases allow TMV reduces photosynthesis	1 AO3 4.4.1.1
02.9	less chlorophyll (so) less glucose / starch / protein made	allow fewer chloroplasts allow less light absorbed ignore less photosynthesis	1 1 AO2 4.4.1.1 4.4.1.3 4.3.1.2
Total		14	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	(has) spikes / thorns / prickles	allow (has a) tough outer layer	1	AO2 4.3.3.2
03.2	chemical		1	AO1 4.3.3.2
03.3	the plant will not lose as much water		1	AO2 4.2.3.2
03.4	chlorophyll / chloroplasts		1	AO2 4.1.1.2
03.5	to allow it to photosynthesise or to make sugar / glucose / carbohydrate / starch		1	AO2 4.4.1.1
03.6	organ		1	AO1 4.2.1
03.7	water / mineral ions	allow named mineral ions allow minerals / ions	1	AO1 4.2.3.1 4.2.3.2
03.8	phloem (tissue)		1	AO1 4.1.1.3 4.2.3.1 4.2.3.2
Total			8	

[illegible]

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	less blood flows through or less blood flows to the heart (muscle / cells / tissue)		1	AO1 4.2.2.3 4.2.2.4
	less oxygen (reaches the heart muscle)	allow less respiration allow less energy released do not accept less energy produced / made / created	1	
05.2	D		1	AO3 4.2.2.4
05.3	B		1	AO3 4.2.2.4
05.4	is more likely to get a blockage (with high cholesterol) or blockage could be biggest	ignore has the highest blood cholesterol concentration	1	AO2 4.2.2.4
05.5	4 and 5.6 $\left(\frac{5.6}{4}\right) = 1.4$	allow correct division using either 5.3 or 5.8 (for person D)	1	AO2 4.2.2.4
			1	
05.6	opens / widens (artery)	allow pushes blockage to the side	1	AO1 4.2.2.4
	so (more) blood can flow through	allow (more) oxygen(ated blood) can flow through	1	
05.7	platelets		1	AO1 4.2.2.3

05.8	Level 2: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3 4.2.2.4
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content:		
	<i>Advantages:</i> • only have to take the tablet once a day • only a tablet so easy to take or only a tablet so not painful to take • (drugs are effective so) less likely to get a blood clot • drugs are cheap so less cost to NHS or drugs are cheap so (more) people can afford them • drugs have been used for a long time so must be safe / trusted <i>Disadvantages:</i> • patients have to make sure they always have a supply of drugs • patients could forget to take the drugs (every day) • patients could still get a blood clot in the first week • restrictions on lifestyle because patients have to have a blood test every few weeks • restrictions on lifestyle because patient can't eat certain foods • patients may get a blood clot if they eat the wrong food • risks associated with puncturing skin / infection • patient may have a fear of needles • higher risk of bleeding / bruising For Level 2 students must evaluate, including consideration of, the advantage and disadvantage of anti-clotting drugs.		
Total		14	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	trachea		1	AO2 4.2.2.2
06.2	any two from: • only one air space (per balloon) or • alveoli not represented • blood vessels / capillaries not represented • bronchioles not represented • glass tube not flexible (like trachea / bronchi) • bell jar does not move during breathing (like ribs) • ribs have gaps between them • rib cage contains muscles • pleural cavity not represented	do not accept bronchi not represented	2	AO3 4.2.2.2
06.3	any two from: • speed (of treadmill) • type of exercise or all were running • (biological) sex or all male • all were non-smokers • time spent running	allow ran for 8 minutes ignore reference to time interval for counting breaths	2	AO2 4.4.2.2
06.4	0 minutes = 20 8 minutes = 42 (42 - 20) ÷ 20 × 100 or 22 ÷ 20 × 100 110 (%)	allow value for 8 minutes in the range 41.5 to 42.5 allow correct substitution from incorrect graph readings (i.e. ±1 small square) at 0 minutes and / or 8 minutes allow correct calculation from incorrect graph readings from previous step	1 1 1	AO2 4.4.2.2

06.5	to get more oxygen (into the blood) for use in respiration or for releasing energy (for muscle contraction) or to remove more carbon dioxide (1) produced in respiration (1)	allow using more oxygen (in muscles) allow to reduce anaerobic respiration do not accept produces / makes / creates energy	1 1	AO2 4.4.2.2 4.4.2.1
06.6	any one from: • heart / pulse rate • depth / volume of breathing • volume of sweat • body temperature	allow heart beat per minute allow amount of sweat allow body mass / measurement	1	AO3 4.4.2.2
06.7	any one from: • (lung) cancer • increased blood pressure • lung disease • low birth weight in babies of mothers who smoke • increased risk of heart / cardiovascular disease	allow named example of lung disease e.g. asthma allow persistent cough ignore cough unqualified	1	AO1 4.2.2.6
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	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
07.2	eyepiece / lens	do not accept objective lens	1	AO1 4.1.1.5 RPA1
07.3	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
07.4	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

07.5	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.				
07.6	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.
08.1	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
08.2	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

08.3	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	AO2 4.1.1.6 RPA 2
08.4	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.
09.1	normal		1	AO2 4.2.2.5 4.2.2.6
09.2	$92 \div 1.71^2$ $31.46(\dots)$ 31.5	allow correctly calculated value using $92 \div 1.71$	1 1 1	AO2 4.2.2.5 4.2.2.6
09.3	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

09.4	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
09.5	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
09.6	<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	

Please write clearly in block capitals.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE BIOLOGY

Foundation Tier Paper 1F

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.



IB/M/Jun22/E/18

8461/1F

Answer all questions in the spaces provided.

01

HIV (Human Immunodeficiency Virus) is a pathogen.

01.1

How is HIV spread from one person to another person?

Tick (✓) one box.

Coughing

Sexual intercourse

Touching door handles

01.2

Describe what happened to the number of new cases of HIV from 2010 to 2018.

Table 1

Year	Number of new HIV cases
2010	2642
2014	2767
2018	1530

IB/M/Jun22/8461/1F

0

1

3

 What could cause a **decrease** in the number of new HIV cases in the future? [1 mark]

Tick (✓) **one** box.

A higher population of people in the UK

☐

A lower number of trained HIV nurses

☐

Better education on how to prevent the spread of HIV

☐

0

1

4

 Scientists have been working to produce a vaccine for HIV for many years.

How could a vaccine work to prevent a person being infected with HIV?

Write the stages **A, B, C, D** and **E** in the correct order.

[3 marks]

The first stage has been completed for you.

- A

 Antibodies attach to the inactive virus.
- B

 Antibodies destroy the inactive virus.
- C

 An inactive form of the virus is injected into the body.
- D

 If the active virus enters the body, antibodies are produced quickly.
- E

 White blood cells produce antibodies to the inactive virus.

C → → → → → → → →

Question 1 continues on the next page

Turn over ►



0

1

5

 When scientists produce a vaccine for a disease the vaccine is tested on live animals. [1 mark]

What is the next stage in testing the vaccine?

Tick (✓) **one** box.

Testing on cells in a laboratory

☐

Testing on healthy volunteers

☐

Testing on the whole human population

☐

0

1

6

 A vaccine for HIV is important because it is difficult to develop safe drugs to destroy viruses.

Why is it difficult to develop safe drugs to destroy viruses?

Tick (✓) **one** box.

Drugs that destroy viruses also damage body tissues.

☐

There are too many viruses for the drugs to destroy.

☐

Viruses are too big for the drugs to destroy.

☐

01.7

Some drugs originated from plants.

Draw one line from each drug to the plant the drug originated from.

[2 marks]

Drug

Aspirin

Digitalis

Plant the drug originated from

Foxglove

Rose

Tobacco

Willow

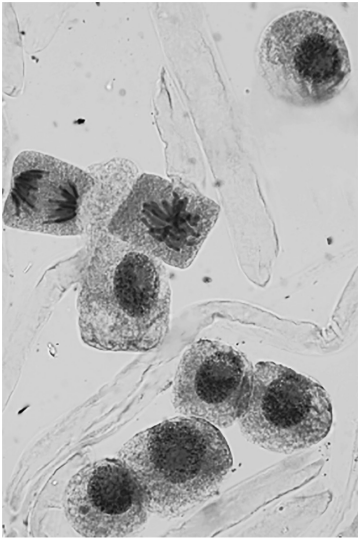
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02

Figure 1 shows animal cells.

Some of the cells are dividing by mitosis for growth and repair.

Figure 1



02.1

What fraction of the cells in Figure 1 is dividing by mitosis?

[1 mark]

Tick (✓) one box.

1/8

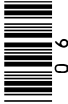
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1/2

3/4

Turn over for the next question

Turn over ▶



02.2

The cells which are **not** dividing in **Figure 1** each contain 10 chromosomes.
One of these cells divides by mitosis to produce two new cells.

How many chromosomes will each new cell contain after mitosis?

Tick (✓) **one** box.

5

10

15

20

[1 mark]

02.3

Cells divide in a series of stages called the cell cycle.
Complete the sentences.
Choose answers from the box.

[3 marks]

contracts	divides	grows
reacts	relaxes	replicates

Before mitosis occurs, the cell _____.
The genetic material in the cell doubles when the DNA _____.
After the chromosomes have been pulled to each end of the cell, the cytoplasm _____.

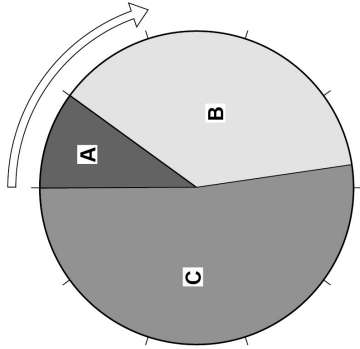
Question 2 continues on the next page

Turn over ►



Figure 2 shows the time taken to complete different stages of the cell cycle.

Figure 2



02.4

Which stage of the cell cycle takes the most time?

Tick (✓) **one** box.

A

B

C

[1 mark]

02.5

What percentage of time in the cell cycle is stage **A**?

Tick (✓) **one** box.

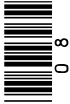
5%

10%

15%

25%

[1 mark]



Stem cells divide by mitosis.
Scientists can use stem cells from an embryo to create heart cells in a laboratory.

02.6 [1 mark] Which organ system contains heart cells?

Tick (✓) **one** box.

- Circulatory system ☐
- Digestive system ☐
- Nervous system ☐
- Respiratory system ☐

02.7 [1 mark] Name **one** medical condition that could be treated using heart cells created from an embryo.

02.8 [1 mark] Give **one** reason why a patient may **not** want to be treated with heart cells created from an embryo.

10

Turn over for next question

Turn over ▶



A scientist investigated the rate of photosynthesis of one type of tomato plant.
The tomato plants were grown in a greenhouse.

Table 2 shows the results.

Table 2

Percentage (%) concentration of carbon dioxide in the air	Rate of photosynthesis in arbitrary units
0.00	0
0.02	5
0.04	16
0.06	19
0.08	20
0.10	20
0.12	20

03.1 Give **two** control variables the scientist should have used in the investigation. [2 marks]

- 1
- 2

03.2 Which range of carbon dioxide concentrations caused the rate of photosynthesis to change the most? [1 mark]

Tick (✓) **one** box.

- From 0.00% to 0.02% ☐
- From 0.02% to 0.04% ☐
- From 0.04% to 0.06% ☐
- From 0.06% to 0.08% ☐



03.3

How could the scientist have improved the validity of the results?

[1 mark]

Tick (✓) **one** box.

Repeat each reading three times and calculate a mean.

☐

Use concentrations of carbon dioxide above 0.12%.

☐

Use different tomato plants for each concentration.

☐

03.4

Explain the change in the rate of photosynthesis when the concentration of carbon dioxide increased between 0.00% to 0.08%.

[2 marks]

03.5

A farmer decided **not** to use a concentration of carbon dioxide higher than 0.08% to grow tomato plants.

Suggest **two** reasons for the farmer's decision.

Use information from **Table 2** and your own knowledge.

[2 marks]

1

2

Turn over for the next question

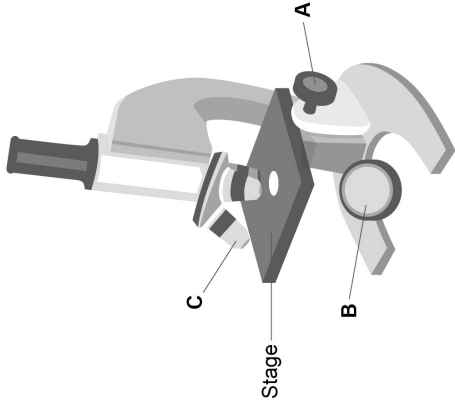
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04

Figure 3 shows a microscope.

Figure 3



04.1

Draw **one** line from each part of the microscope to the function of the part.

[3 marks]

Part of the
microscope

Function

A

To adjust the focus of the microscope

B

To direct light into the viewer's eye

C

To hold a slide in place

To magnify the image of a specimen

To support the microscope



A student prepared some onion cells.

The student viewed the onion cells using a microscope.

This is the method used.

1. Cut an onion into pieces using a sharp knife.
2. Peel off a thin layer of cells from one piece.
3. Place the layer of cells onto a microscope slide.
4. Add three drops of iodine solution to the layer of cells.
5. Cover with a cover slip.
6. Place the slide on the stage of the microscope.

04.2

Why was iodine solution added to the layer of onion cells?

Tick (✓) **one** box.

- To dry the cells ☐
- To separate the cells ☐
- To stain the cells ☐

[1 mark]

04.3

Why was a **thin** layer of onion cells used?

Tick (✓) **one** box.

- To allow light to pass through the cells ☐
- To allow oxygen to pass through the cells ☐
- To allow water to pass through the cells ☐

[1 mark]

Question 4 continues on the next page

Turn over ►

The student was worried about using a sharp knife to cut the onion.

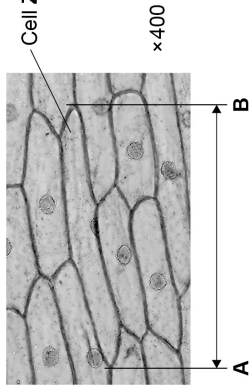
The student wrote a risk assessment for using a knife.

Draw **one** line from each part of the risk assessment to the description of the part. **[2 marks]**

Part of risk assessment	Description
Hazard	Call a first aider
Plan to minimise risk	Cut the onion on a chopping board
	The onion is cut into pieces
	The knife is sharp

Figure 4 shows what the student saw using the microscope at a magnification of $\times 400$.

Figure 4



04.5

Line **A–B** in **Figure 4** shows the length of cell **Z**.

Calculate the real length of cell **Z**.

Complete the following steps.

[4 marks]

Measure the length of line **A–B** in millimetres (mm).

Length of line **A–B** = _____ mm

Give your measurement of the length of line **A–B** in micrometres (µm).

1 mm = 1 000 µm

Length of line **A–B** = _____ µm

Calculate the real length of cell **Z**.

Use the equation:

real length of cell **Z** (in µm) = $\frac{\text{length of line A–B (in µm)}}{\text{magnification}}$

Real length of cell **Z** = _____ µm

Question 4 continues on the next page

Turn over ►



04.6

How would onion cells look different if they were seen using an electron microscope?

[2 marks]

Tick (✓) **two** boxes.

The cells would be coloured.

☐

The cells would have no nuclei.

☐

The cells would look larger.

☐

The cells would look more blurred.

☐

The cells would show more internal structures.

☐

04.7

Figure 4 is repeated below.

Figure 4

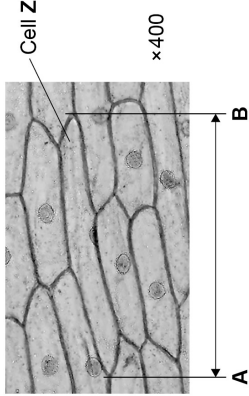
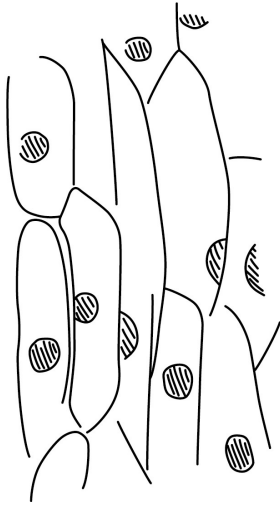


Figure 5 shows the student's drawing of Figure 4.

Figure 5

ONION CELLS



What **two** improvements could the student make to the drawing in Figure 5?
[2 marks]

Tick (✓) **two** boxes.

Add colour to the cells.

☐

Complete the cell walls.

☐

Draw each cell on a separate piece of paper.

☐

Include the magnification.

☐

Use a ruler to draw the cells.

☐

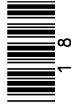
15

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Plants take up water from the soil through their roots.
Some of the water is used for photosynthesis.

Complete the word equation for photosynthesis.
Choose answers from the box.

[2 marks]

fat	glucose	nitrogen	oxygen	protein
-----	---------	----------	--------	---------

carbon dioxide + water → _____ + _____

Water and dissolved substances are transported through a plant.

Complete the sentences.

Choose answers from the box.

[3 marks]

epidermis	guard cells	palisade cells
phloem	stomata	xylem

Water moves from the roots to the leaves in the _____.

Water is lost from leaves through pores called _____.

Dissolved sugars are transported in the _____.

Question 5 continues on the next page

Turn over ►



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Table 3 shows the rate of transpiration in four different plant species.

Table 3

Plant species	Rate of transpiration in arbitrary units
A	310
B	254
C	87
D	192

Calculate how many times greater the rate of transpiration of species A is than the rate of transpiration of species B.

Give your answer to 2 significant figures.

[3 marks]

0 5 . 3

Number of times greater (2 significant figures) = _____



05.4

Which factor could cause species **A** to have a higher rate of transpiration than species **B**?

[1 mark]

Tick (✓) **one** box.

- Each flower of species **A** has more petals. ☐
- Each leaf of species **A** has more stomata. ☐
- Each plant of species **A** has shorter roots. ☐

05.5

Which environmental change would cause an increase in the rate of transpiration?

[1 mark]

Tick (✓) **one** box.

- Decreased light intensity ☐
- Decreased wind speed ☐
- Increased humidity ☐
- Increased temperature ☐

05.6

Which plant species in **Table 3** is most likely to live in a dry desert?

[1 mark]

Tick (✓) **one** box.

- | | | | | | | | |
|----------|--------------------------|----------|--------------------------|----------|--------------------------|----------|--------------------------|
| A | ☐ | B | ☐ | C | ☐ | D | ☐ |
|----------|--------------------------|----------|--------------------------|----------|--------------------------|----------|--------------------------|

Question 5 continues on the next page

Turn over ►

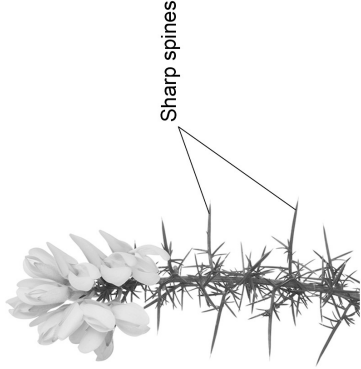


05.7

Some plants have adaptations that help them survive.

Figure 6 shows part of a gorse plant.

Figure 6



How will the sharp spines help the gorse plant survive?

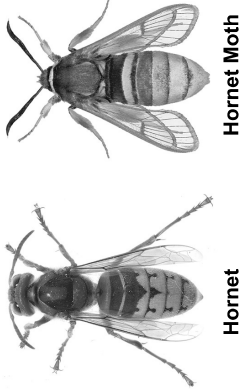
[1 mark]



0 5 . 8 Animals also have adaptations to help them survive.

Figure 7 shows two insects.

Figure 7



Hornets are insects that sting other animals and cause pain.

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

Explain why animals avoid eating the **hornet moth**.

[2 marks]

14

Turn over for the next question

Turn over ▶



Table 4 shows information about four jellyfish.

The jellyfish are listed in order of increasing size.

Table 4

Jellyfish	Size of jellyfish	Surface area in mm ²	Volume in mm ³	Surface area to volume ratio
A	Smallest ↓ Largest	3 600	1 200	X:1
B		50 000	25 000	2:1
C		1 800 000	6 000 000	0.3:1
D		7 500 000	125 000 000	0.06:1

Calculate value **X** in Table 4.

0 6 . 1 [2 marks]

X =

Describe the relationship between the size of a jellyfish and its surface area to volume ratio.

Use Table 4.

[1 mark]

0 6 . 2



This question is about cells and transport.

07.1

Complete Table 5.

07.1

[3 marks]

Table 5

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.

What is the function of chloroplasts?

07.2

[1 mark]

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

07.3

[1 mark]

Question 7 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.

07.4

What is the independent variable in the investigation?

Tick (✓) **one** box.

[1 mark]

Concentration of salt solution

☐

Mass of potato piece

☐

Time potato is left in salt solution

☐

Volume of salt solution

☐

07.5

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.

07.6

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.

[2 marks]

Use the equation:

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

Percentage increase in mass = _____ %

Question 7 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 6 shows the results.

Table 6

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

07.7

Complete Figure 9.

You should:

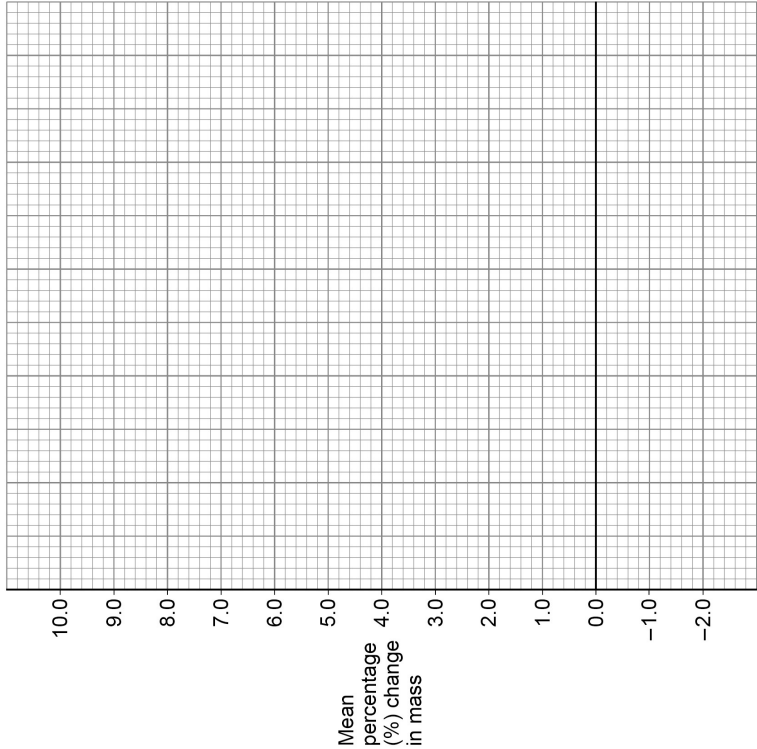
- label the x-axis
- use a suitable scale for the x-axis
- plot the data from Table 6
- draw a line of best fit.

[4 marks]



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Figure 9



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

Use Figure 9.

[1 mark]

Concentration = _____ mol/dm³

Question 7 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]

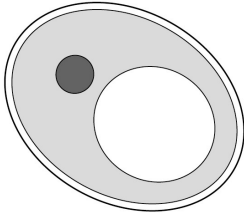


08.

Plant cells and fungal cells are similar in structure.

Figure 10 shows a fungal cell.

Figure 10



08.1

Name **one** structure in **Figure 10** which is present in both plant cells and fungal cells but **not** in animal cells.

[1 mark]

08.2

Which disease is caused by a fungus?

[1 mark]

Tick (✓) **one** box.

Gonorrhoea

☐

Malaria

☐

Measles

☐

Rose black spot

☐

Question 8 continues on the next page

Turn over ►

08.3

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.

08.4

Where is protein digested in the human digestive system?

Tick (✓) **one** box.

- Large intestine ☐
- Liver ☐
- Salivary glands ☐
- Stomach ☐

[1 mark]

08.5

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 8 continues on the next page

Turn over ▶

Table 7 shows some information about burgers made from meat and meat-free burgers.

08.6

Table 7

	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 7** and your own knowledge.

[6 marks]

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END OF QUESTIONS

12

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Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	sexual intercourse		1	AO1 4.3.1.1 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	increased (at first) (then) decreased	ignore numbers unqualified do not accept an implication of an overall increase if no other mark awarded allow (overall) decrease for 1 mark	1 1	AO3 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	better education on how to prevent the spread of HIV		1	AO3 4.3.1.1 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(C) → E → A → B → D	allow 1 mark for E → A link allow 1 mark for A → B link allow 1 mark for B → D link if no other mark awarded allow 1 mark for an answer of (C) → E → B → A → D	3	AO1 4.3.1.1 4.3.1.6 4.3.1.7 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	testing on healthy volunteers		1	AO1 4.3.1.9
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	drugs that destroy viruses also damage body tissues		1	AO1 4.3.1.8
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	Drug Aspirin Digitalis Plant the drug originated from Foxglove Rose Tobacco Willow do not accept more than one line from a box on the left		1	AO1 4.3.1.1 4.3.1.9
Total Question 1			11	

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	$1\frac{1}{4}$		1	AO2 4.1.2.2
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	10		1	AO2 4.1.2.2
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	grows replicates divides	must be in this order	1 1 1	AO1 4.1.2.2
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	C		1	AO3 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	10%		1	AO2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	circulatory system		1	AO1 4.2.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	cardiovascular disease / CVD or (coronary) heart disease / CHD	allow heart attack allow any correctly named heart condition eg arrhythmia, hole in the heart	1	AO1 4.2.2.4 4.1.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	any one from: - unethical (against) religious / cultural / personal beliefs - the method is not (fully) tested - risk of infection (heart cells) may be rejected	allow examples of unethical such as destroying a (potential) life allow against God's will ignore religion unqualified allow the method might not work allow may cause side effects	1	AO2 4.1.2.3 4.2.2.4

Total Question 2	10
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Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any two from: - temperature - size of tomato plants or size / number of leaves - light (volume of) water (amount / type of) fertiliser / minerals / ions / nutrients (given to plants) - time before rate readings are taken	allow age of plant allow (amount of) water allow (type of) compost / soil allow named example of mineral ion such as nitrate / magnesium ignore time unqualified ignore type of tomato plant ignore type of greenhouse	2	AO3 4.4.1.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	from 0.02% to 0.04%		1	AO3 4.4.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	repeat each reading three times and calculate a mean		1	AO3 4.4.1.2 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	(the rate of photosynthesis) increases	ignore values	1	AO2 4.4.1.1 4.4.1.2
	(because) carbon dioxide is needed for photosynthesis	allow 2 marks for (there is) more carbon dioxide for (more) photosynthesis	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	any two from: - it would not increase the rate (of photosynthesis) - it would not increase the growth of tomatoes - it would cost more	allow it would not change the rate (of photosynthesis) allow photosynthesis would not increase allow idea of profit will not increase allow reference to avoiding global warming	2	AO3 4.4.1.2

Total Question 3	8
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Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	Part of the microscope	Function		AO2 4.1.1.2 RPA1
	A	To adjust the focus of the microscope	1	
	B	To direct light into the viewer's eye	1	
	C	To magnify the image of a specimen	1	
		To hold a slide in place		
		To support the microscope		
	do not accept more than one line from a box on the left			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	to stain the cells		1	AO2 4.1.1.2 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	to allow light to pass through the cells		1	AO2 4.1.1.2 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	Risk assessment Hazard Call a first aider Cut the onion on a chopping board The onion is cut into pieces Plan to minimise risk The knife is sharp do not accept more than one line from a box on the left		1 1	AO3 4.1.1.2 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	<i>student's measurement</i> 49 (mm) <i>conversion of student's measurement</i> 49 000 (µm) <i>substitution</i> $\frac{49\,000}{400}$ 122.5 (µm)	allow in range 48 – 50 (mm) allow correct conversion using student's measurement allow a correct substitution using incorrectly measured / converted length allow a correct answer from student's division using a magnification of x400	1 1 1 1	AO2 4.1.1.5 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	the cells would look larger the cells would show more internal structures		1 1	AO1 4.1.1.5
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	complete the cell walls include the magnification		1 1	AO3 4.1.1.5 RPA1
Total Question 4			15	

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	oxygen glucose	in either order allow O ₂ allow C ₆ H ₁₂ O ₆	1 1	AO1 4.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	xylem stomata phloem	must be in this order	1 1 1	AO1 4.1.1.3 4.2.3.1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	$\frac{310}{254}$ 1.22047 ... 1.2	allow an answer of 0.82 if numerator and denominator reversed	1 1 1	AO2 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	each leaf of species A has more stomata		1	AO3 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	increased temperature		1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	C		1	AO2 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	(spines) stop the plant being eaten or (spines) prevent animals damaging the plant	allow any named animal allow to reduce water loss	1	AO2 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	it looks like the hornet (so) animals avoid the risk of being stung	allow animals think it is a hornet allow (so) animals avoid the risk of pain	1 1	AO3 AO2 4.3.3.2

Total Question 5		14
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Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1 View with Table 4	$\begin{array}{r} 3\ 600 \\ 1\ 200 \\ \hline 3 \end{array}$	if no answer in answer space allow answer in Table 4 allow 3:1 do not accept if a unit is given	1 1	AO2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	as size increases, (surface area to volume) ratio decreases	allow as one increases, the other decreases allow as size decreases, (surface area to volume) ratio increases	1	AO3 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	any one from: - carbon dioxide - glucose / sugar - water - ions / minerals / salts	allow a correct chemical formula allow named ions allow other correct substances eg amino acids / fatty acids / glycerol ignore nutrients / food	1	AO1 4.1.3.2 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	any two from: - concentration gradient - surface area - thickness of exchange surface - presence of a blood / circulatory system - temperature	allow description allow surface area : volume ratio ignore size unqualified allow thickness of skin	2	AO1 4.1.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	gills		1	AO1 4.1.3.1

Question	Answers	Mark	AO / Spec. Ref.
06.6	Level 3: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	4.1.3.1 4.2.2.2
	Indicative content		
	- large number of alveoli - large surface / area - alveolus and blood vessel / capillary are in close proximity - alveoli / capillaries have thin <u>walls</u> or alveoli / capillaries have walls that are one cell thick - to reduce diffusion distance - has a good blood supply or has a capillary network - to maintain concentration gradient - to remove oxygen quickly or to deliver carbon dioxide quickly (capillary network) increases surface area (for diffusion) - lungs are ventilated or lungs continually move air in and out (ventilation) brings in oxygen or removes carbon dioxide - to maintain concentration gradient Types of adaptation of the lungs are required for Level 3.		
Total Question 6		13	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	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.
07.2	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.
07.3	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.
07.4	concentration of salt solution		1	AO1 4.1.3.2 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	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.
07.6	$\frac{0.2}{2.5} \times 100$ 8(%)	$\text{allow } \frac{2.7 - 2.5}{2.5} \times 100$ if no other mark awarded allow 1 mark for $\frac{2.5 - 2.7}{2.5} \times 100 = -8 (\%)$	1 1	AO2 4.1.3.2 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7 Mark with 07.8	correct scale and axis labelled (<u>concentration</u> (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 2	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	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.8 Mark with 07.7	correct answer from their line drawn on Figure 9	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 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.9	<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	allow (because) the solution outside the cells / potato is more concentrated than inside	1	
	or (because) the solution in the cells / potato is more dilute than outside	allow (because) the solution outside the cells / potato is less dilute than inside		
		allow correct references to <u>water concentration</u> / <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		
Total Question 7			17	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	(cell) wall or (large / permanent) vacuole	ignore cellulose	1	AO3 4.1.1.1 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	rose black spot		1	AO1 4.3.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	24×60 $\frac{\quad}{90}$ 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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	stomach		1	AO1 4.2.2.1

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

Question	Answers	Mark	AO / Spec. Ref.
08.6	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 8		12	