AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE BIOLOGY

H

Higher Tier Paper 1H

Time allowed: 1 hour 45 minutes

Materials

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

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

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

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.

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There are no questions on this page

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ANSWER IN THE SPACES PROVIDED

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

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0 1 This question is about cells and transport.

0 1 . 1 Complete **Table 1**.

[3 marks]

Table 1

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

Cells in potatoes are plant cells.

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

0 1 . 2 What is the function of chloroplasts?

[1 mark]

0 1 . 3 Name **one** type of cell in a potato plant that does **not** contain chloroplasts.

[1 mark]

Question 1 continues on the next page

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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 cm^3 of 0.4 mol/dm^3 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.

0 1 . 4 What is the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

Concentration of salt solution ☐

Mass of potato piece ☐

Time potato is left in salt solution ☐

Volume of salt solution ☐

0 1 . 5 Why did the student dry the surface of each potato piece with a paper towel in step **5**?

[1 mark]

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

0 1 . 6 For one potato piece:

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

Calculate the percentage increase in mass of the potato piece.

[2 marks]

Use the equation:

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

Percentage increase in mass = _____ %

Question 1 continues on the next page

Do not write outside the box

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

Table 2 shows the results.

Table 2

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

0 1 . 7 Complete **Figure 1**.

You should:

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

[4 marks]

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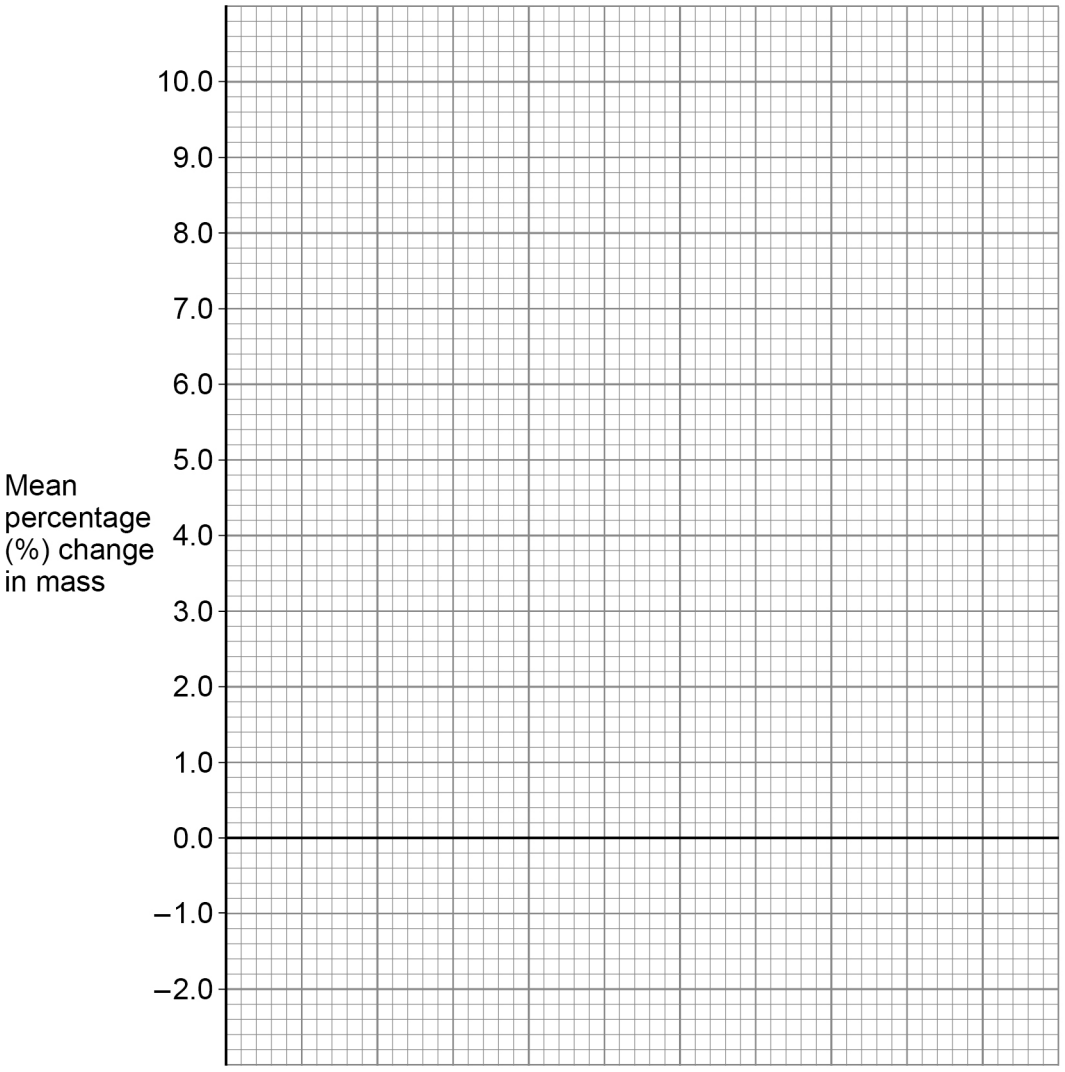
Figure 1



0 1 . 8 What concentration of salt solution was equal to the concentration of the solution inside the potato pieces?

Use **Figure 1**.

[1 mark]

Concentration = _____ mol/dm^3

Question 1 continues on the next page

Turn over ►

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0 1 . 9 Explain why the potato pieces in the 0.4 mol/dm^3 salt solution decreased in mass.

[3 marks]

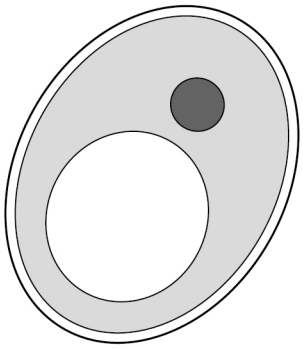
17

Do not write outside the box

0 2 Plant cells and fungal cells are similar in structure.

Figure 2 shows a fungal cell.

Figure 2



0 2 . 1 Name **one** structure in **Figure 2** which is present in both plant cells and fungal cells but **not** in animal cells.

[1 mark]

---

0 2 . 2 Which disease is caused by a fungus?

[1 mark]

Tick (✓) **one** box.

Gonorrhoea ☐

Malaria ☐

Measles ☐

Rose black spot ☐

Question 2 continues on the next page

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0 2 . 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 = _____

Do not write outside the box

Some types of fungal cell are grown to produce high-protein food.

The high-protein food can be used to make meat-free burgers.

0 2 . 4 Where is protein digested in the human digestive system?

[1 mark]

Tick (✓) **one** box.

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

0 2 . 5 Which chemical could be used to test if the burgers contain protein?

[1 mark]

Tick (✓) **one** box.

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

Question 2 continues on the next page

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0 2 . 6 **Table 3** shows some information about burgers made from meat and meat-free burgers.

Table 3

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

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

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

[6 marks]

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12

Turn over for next question

Do not write outside the box

0 3 A student prepared some onion cells.

The student viewed the onion cells using a light microscope.

This is the method used.

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

0 3 . 1 **Table 4** shows a risk assessment for this experiment.

Complete **Table 4**.

[2 marks]

Table 4

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

Do not write outside the box

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

[3 marks]

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

Iodine solution is added to the onion epidermis.

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

Question 3 continues on the next page

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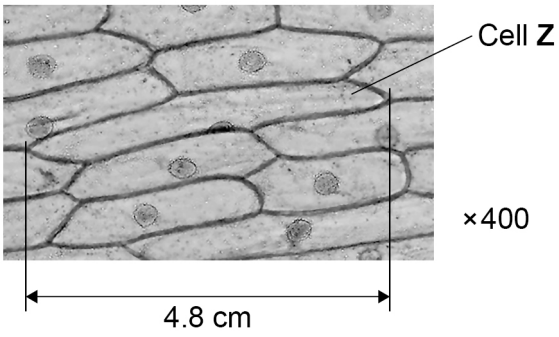
Figure 3 shows what the student saw under the microscope at a magnification of ×400.

Figure 3



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

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

Give your answer in micrometres (μm).

[5 marks]

Real length of cell **Z** = _____ μm

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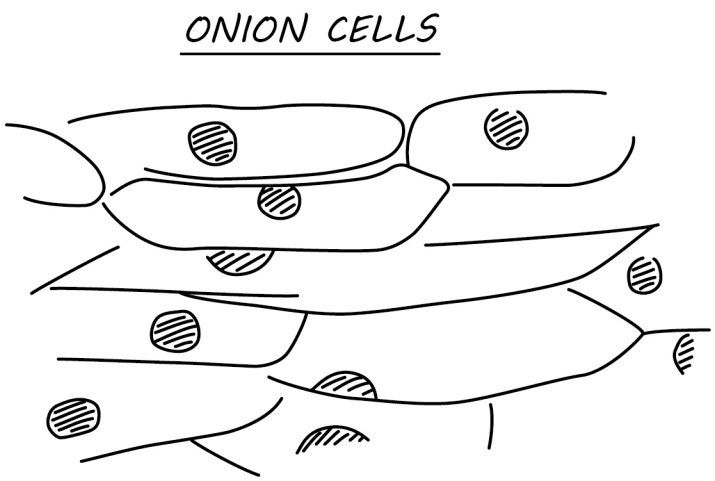
Figure 4 shows the student's drawing of **Figure 3**.

Figure 4



0 3 . 4 Give **two** ways the student could improve the drawing in **Figure 4**.

[2 marks]

1 _____

_____

2 _____

_____

0 3 . 5 Onion cells can be seen using an electron microscope.

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

[2 marks]

1 _____

_____

2 _____

_____

14

Turn over for the next question

Do not write outside the box

0 4 Plants and animals have many defence responses.

0 4 . 1 **Table 5** shows some plant defences.

Identify whether each defence is a chemical response or a physical response.

[2 marks]

Tick (✓) **one** box in each row.

Table 5

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

Do not write outside the box

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

Figure 5 shows two insects.

Figure 5

Hornet **Hornet Moth**

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

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

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

[1 mark]

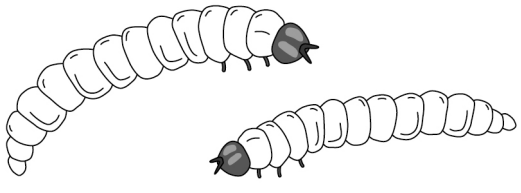
Question 4 continues on the next page

Do not write outside the box

Adult hornet moths lay eggs that hatch into larvae.

Figure 6 shows the larvae of a hornet moth.

Figure 6



0 4 . 3 The larvae of the hornet moth:

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

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

[6 marks]

Do not write outside the box

0 4 . 4 The larvae of the hornet moth form when fertilised eggs divide by mitosis.

Describe how mitosis produces two genetically identical cells.

[4 marks]

0 4 . 5 The cells which are first formed from the fertilised eggs of the hornet moth are stem cells.

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

[1 mark]

14

Turn over for the next question

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0 5 Water and carbon dioxide are exchanged between leaves and the atmosphere through pores called stomata.

0 5 . 1 Name the cells that control the opening and closing of the stomata.

[1 mark]

Water moves through a plant in the transpiration stream.

0 5 . 2 Describe **two** differences between the transpiration stream and translocation.

[2 marks]

1

2

0 5 . 3 Which environmental conditions would cause the rate of transpiration to be greatest in a plant?

[1 mark]

Tick (✓) **one** box.

- Cold with low humidity ☐
- Cold with high humidity ☐
- Warm with low humidity ☐
- Warm with high humidity ☐

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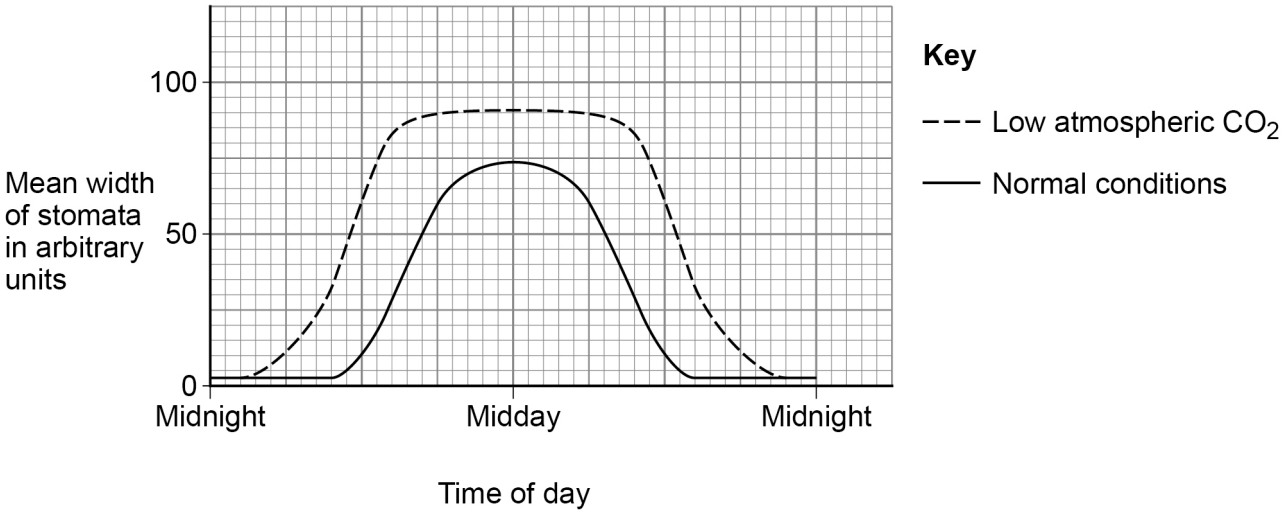
Figure 7 shows information about the mean width of the stomata in a plant.

Figure 7



0 5 . 4 The changes in the mean width of the stomata in **normal conditions** are an advantage to the plant.

Explain how.

[4 marks]

Do not write outside the box

0 5 . 5 The changes in the mean width of the stomata in low atmospheric carbon dioxide are different from the changes in normal conditions.

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

[2 marks]

10

Turn over for the next question

Do not write outside the box

0 6 **Table 6** shows information about five different organisms.

Table 6

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

0 6 . 1 Calculate value **X** in **Table 6**.

Give your answer to the nearest whole number.

[3 marks]

X (nearest whole number) = _____

0 6 . 2 What is the relationship between the size of an organism and its surface area to volume ratio?

Use **Table 6**.

[1 mark]

Do not write outside the box

0 6 . 3 Organism **B** exchanges gases with the environment directly through its skin.

Organism **D** exchanges gases with the environment using its respiratory system.

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

[2 marks]

Question 6 continues on the next page

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Table 6 is repeated below.

Table 6

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

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

Table 7

Organism	Metabolic rate in arbitrary units
D	890
E	75

Do not write outside the box

0 6 . 4 Organisms **D** and **E** both keep a constant body temperature (warm-blooded).

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

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

[4 marks]

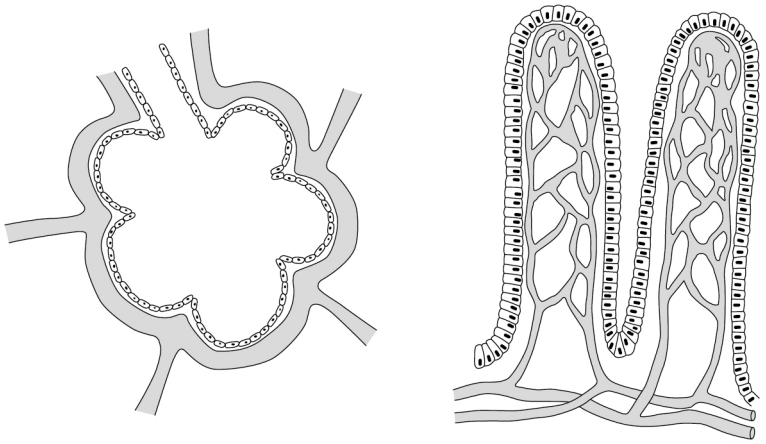
Question 6 continues on the next page

Do not write outside the box

0 6 . 5 Organism **D** and organism **E** both have alveoli in the lungs and villi in the small intestine.

Figure 8 shows some alveoli and some villi.

Figure 8



Alveoli **Villi**

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

[4 marks]

14

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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

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

[1 mark]

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

Table 8

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

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

[2 marks]

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

[1 mark]

Do not write outside the box

0 7 . 4 Calculate the ratio of new cases of HIV in women to new cases of HIV in men in 2018.

Give your answer to 3 significant figures.

[3 marks]

Ratio (3 significant figures) = _____ : 1

0 7 . 5 In the UK population the total number of women is greater than the total number of men.

The data in **Table 8** is used to compare the proportions of new cases of HIV in the population for men and women.

Suggest how the data could be presented differently so that a more valid comparison can be made.

[1 mark]

Question 7 continues on the next page

Do not write outside the box

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

0 7 . 6 Explain how a vaccine for HIV could work to prevent a person developing HIV infection.

[4 marks]

A person with late stage HIV infection has AIDS.

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

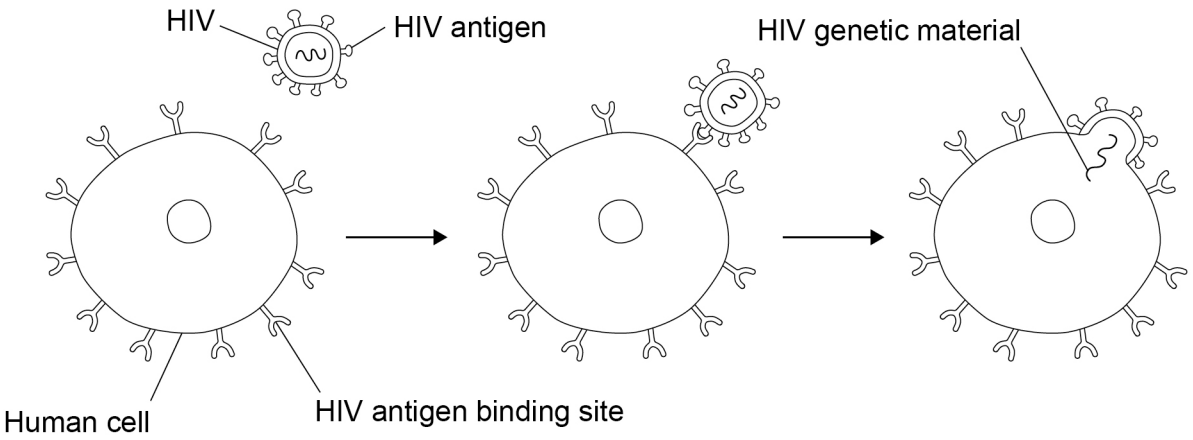
0 7 . 7 Describe how the monoclonal antibody for HIV can be produced.

[4 marks]

Do not write outside the box

0 7 . 8 **Figure 9** shows how HIV enters a human cell.

Figure 9



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

Use information from **Figure 9**.

[3 marks]

19

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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

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GCSE
BIOLOGY
8461/1H

Paper 1 Higher Tier

Mark scheme

June 2022

Version: 1.0 Final Mark Scheme

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the examiner make their judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent (for example, a scientifically correct answer that could not reasonably be expected from a student's knowledge of the specification)..

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**.
Alternative words in the mark scheme are shown by a solidus eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name **two** magnetic materials.

[2 marks]

Student	Response	Marks awarded
1	iron, steel, tin	1
2	cobalt, nickel, nail*	2

3.2 Use of symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, or uses symbols to denote quantities in a physics equation, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. At any point in a calculation students may omit steps from their working. If a subsequent step is given correctly, the relevant marks may be awarded.

Full marks are **not** awarded for a correct final answer from incorrect working.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

An error can be carried forward from one question part to the next and is shown by the abbreviation 'ecf'.

Within an individual question part, an incorrect value in one step of a calculation does not prevent all of the subsequent marks being awarded.

3.6 Phonetic spelling

Marks should be awarded if spelling is not correct but the intention is clear, **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do <u>not</u> accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

3.11 Numbered answer lines

Numbered lines on the question paper are intended to support the student to give the correct number of responses. The answer should still be marked as a whole.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and, if necessary, annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level.

The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

Question 1

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

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

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

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

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

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7 Mark with 01.8		max **3** marks for bar chart		AO2 4.1.3.2 RPA3
	correct scale **and** axis labelled (concentration (of salt solution) in mol/dm^3)	scale must take up at least 50% of grid	1	
	all points plotted correctly	allow a tolerance of ± ½ small square allow 3 or 4 correct plots for **1** mark	2	
	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.
01.8 Mark with 01.7	correct answer from their line drawn on **Figure 1**	allow a tolerance of ± ½ small square ignore line joined point to point with straight lines if a line of best fit is drawn if no line of best fit is drawn, allow an answer in the range 0.31 – 0.33 (mol/dm^3)	1	AO2 4.1.3.2 RPA3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.9	<u>water</u> moves out of cells / potato	allow 'pieces' for potato throughout	1	AO2 4.1.3.2 RPA3
	by osmosis	allow by diffusion through a partially / selectively / semi permeable membrane	1	
	(because) the solution in the cells / potato is less concentrated than outside **or** (because) the solution in the cells / potato is more dilute than outside	allow (because) the solution outside the cells / potato is more concentrated than inside allow (because) the solution outside the cells / potato is less dilute than inside allow correct references to <u>water 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	1	

Total Question 1		**17**

Question 2

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

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$\frac{24 \times 60}{90}$ **or** $\frac{24}{1.5}$ 16	allow $\frac{1440}{90}$ do **not** accept if a unit is given	1 1	AO2 4.1.1.6 4.1.1.1

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

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

Question	Answers	Mark	AO / Spec. Ref.
02.6	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5-6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3-4	AO2
	Level 1: Relevant points are made. They are not logically linked.	1-2	AO1
	No relevant content.	0	4.2.2.1 4.2.2.4 4.2.2.5 4.2.2.6

	Indicative content
	
	• meat-free burgers contain more fibre
	  • aids digestion **or** prevents constipation
	
	• meat burgers contain more protein
	  • for growth
	
	• meat burgers contain more fat
	  • can cause CHD **or** heart attack **or** narrowing of arteries
	  • may lead to needing a stent
	  • may lead to obesity
	  • obesity is a risk factor for (type 2) diabetes
	
	• meat burgers contain more cholesterol
	  • can cause narrowing of arteries **or** CHD **or** heart attack
	  • may lead to needing a stent
	  • may need to take statins
	
	• both burgers have similar amounts of carbohydrate
	  • good for providing energy
	
	• no information on vitamins / minerals provided for either burger
	
	• meat burgers require animals to be farmed
	  • increase in methane in atmosphere
	  • (methane) contributes to global warming
	
	• meat burgers require animals to be slaughtered
	  • ethical issues
	
	• some people won't eat meat-free burgers
	  • (because) some people don't like the idea of eating fungus
	  • (because) some people prefer the taste of meat
	
	For **Level 2**, comparisons and linked reasons using own knowledge are required.		

Total Question 2		**12**

Question 3

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>03.1</td><td>
<table>
<tr><th>Hazard</th><th>Risk</th><th>Plan to minimise risk</th></tr>
<tr><td>Iodine solution is an irritant</td><td>May cause allergic reaction or skin rash</td><td>wash skin immediately (after contact)
or
wear gloves
or
clean up spills

allow method to prevent spills e.g. use a dropper bottle

ignore do not spill</td></tr>
<tr><td>Sharp knife</td><td>may cut you / someone / skin</td><td>cut away from the body
or
cut on a chopping board
or
keep fingers away from blade (when cutting)

allow description of how to carry knife safely

ignore use a blunt knife</td></tr>
</table>
1 mark for each correct row
</td><td>1

1</td><td>AO3
4.1.1.5
RPA1</td></tr>
</table>

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

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

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

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

Total Question 3		**14**

Question 4

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

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

Question	Answers	Mark	AO / Spec. Ref.
04.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2 4.2.3.1 4.2.3.2 4.4.1.1 4.4.1.3 4.3.3.1
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	

	Indicative content
	
	• less absorption of water
	  ○ less water so lower rate of photosynthesis
	  ○ so less glucose produced
	  ○ for respiration / energy release
	  ○ so less cellulose produced so fewer cells walls / cells made
	  ○ so fewer amino acids produced to make new proteins
	  ○ cells lose turgidity
	
	• less absorption of (named) ions / minerals
	  ○ fewer nitrates so fewer proteins made for growth
	  ○ fewer magnesium ions so less chlorophyll produced
	  ○ so lower rate of photosynthesis
	
	• damage to phloem
	  ○ less transport of sugars to root cells
	  ○ for respiration / energy release
	
	• damage to xylem
	  ○ less water transported (to cells)
	  ○ fewer nitrates reach cells
	  ○ so fewer proteins made for growth
	  ○ fewer magnesium ions reach cells
	  ○ so less chlorophyll produced
	  ○ less magnesium / chlorophyll so lower rate of photosynthesis
	
	• less anchorage		

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

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

Total Question 4		**14**

Question 5

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

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

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

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

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

Total Question 5		**10**

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	$\frac{9.96 \times 10^{-3}}{1.35 \times 10^{-4}}$ 73.77… 74 (:1)	if no answer in answer space allow answer in **Table 6** allow $\frac{0.00996}{0.000135}$ allow a correctly derived whole number from an incorrect calculation do **not** accept if unit is given	1 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 they are inversely proportional **or** they are negatively correlated allow as one increases, the other decreases allow as size decreases, (surface area to volume) ratio increases	1	AO2 4.1.3.1

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

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

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

Total Question 6		**14**

Question 7

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

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

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

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	any **one** from: • calculate as a percentage • give the numbers per 100 000 people	ignore calculate as a proportion allow any standard number eg 10 000 / 1000	1	AO3 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6		ignore reference to WBC unqualified		AO1 4.3.1.7
	inactive HIV / virus is injected (into bloodstream / muscle / body)	allow dead HIV / virus is injected (into bloodstream / muscle / body) allow (named) part of HIV / virus is injected (into bloodstream / muscle / body)	1	4.3.1.6 4.3.1.2
	white bloods cells produce antibodies (against inactive virus)	allow lymphocytes produce antibodies (against inactive virus) do **not** accept phagocytes produce antibodies (against inactive virus)	1	
	(if infected with HIV) correct / specific antibodies are produced quickly		1	
	antibodies destroy the (active) virus / HIV	allow antibodies 'kill' the (active) virus / HIV	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	HIV / antigen / protein injected into mouse	allow other correct small mammals eg rat	1	AO1 4.3.2.1
	extract / collect (mouse) lymphocytes that make a specific antibody to HIV / antigen / protein	allow extract specific lymphocytes from someone with HIV for **2** marks	1	
	lymphocytes are combined with a tumour cell to create a <u>hybridoma</u>	allow lymphocytes are combined with a myeloma / cancer cell to create a <u>hybridoma</u>	1	
	(hybridoma) <u>cloned</u> to create many cells that produce the antibody		1	
		alternative route HIV / antigen / protein injected into mouse (1) lymphocytes from mouse are combined with a tumour cell to create a <u>hybridoma</u> (1) the hybridoma that makes the specific / correct antibody is isolated (1) (hybridoma) <u>cloned</u> to create many cells that produce the antibody (1)		

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

Total Question 7		**19**