



---

**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](http://aqa.org.uk)

#### **Copyright information**

AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre..

Copyright © 2022 AQA and its licensors. All rights reserved.

## 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 **not** 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     | nucleus                       | must be in this order<br>allow chromosomes<br>allow plasmid                                                                                          | 1    | AO1<br>4.1.1.1<br>4.1.1.2 |
|          | (site of aerobic) respiration | allow makes ATP<br><b>or</b> releases energy<br>do <b>not</b> accept produces / makes / creates energy<br>do <b>not</b> accept anaerobic respiration | 1    |                           |
|          | (cell) membrane               |                                                                                                                                                      | 1    |                           |

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

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

| Question | Answers                        | Extra information | Mark | AO / Spec. Ref.        |
|----------|--------------------------------|-------------------|------|------------------------|
| 01.4     | concentration of salt solution |                   | 1    | AO1<br>4.1.3.2<br>RPA3 |

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

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



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

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

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

## Question 2

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

| Question | Answers         | Extra information | Mark | AO / Spec. Ref. |
|----------|-----------------|-------------------|------|-----------------|
| 02.2     | rose black spot |                   | 1    | AO1<br>4.3.1.4  |

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

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|----------|---------|-------------------|------|-----------------|
| 02.4     | stomach |                   | 1    | AO1<br>4.2.2.1  |

---

| Question | Answers        | Extra information | Mark | AO /<br>Spec. Ref.     |
|----------|----------------|-------------------|------|------------------------|
| 02.5     | biuret reagent |                   | 1    | AO1<br>4.2.2.1<br>RPA4 |

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

|                         |  |           |
|-------------------------|--|-----------|
| <b>Total Question 2</b> |  | <b>12</b> |
|-------------------------|--|-----------|

Question 3

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

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

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

| Question | Answers                                                                                                                                                                                                                                                                                                                                                                                                                                 | Extra information                                                                      | Mark | AO / Spec. Ref.        |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------|------------------------|
| 03.4     | any <b>two</b> from: <ul style="list-style-type: none"> <li>• include magnification / scale</li> <li>• use continuous lines</li> <li>• do not draw overlapping cells</li> <li>• draw (wider) cell walls</li> <li>• do not shade</li> <li>• draw all the cells present</li> <li>• draw correct cell shapes</li> <li>• do not have gaps between cells</li> <li>• draw nuclei in correct location</li> <li>• label cell part(s)</li> </ul> | ignore make it neater<br><br>allow do not colour<br><br>allow label named cell part(s) | 2    | AO3<br>4.1.1.2<br>RPA1 |



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

|                         |  |           |
|-------------------------|--|-----------|
| <b>Total Question 3</b> |  | <b>14</b> |
|-------------------------|--|-----------|

**Question 4**

| Question                          | Answers                                                                                                                                                                                                                                                                                                                                                                                                                  | Extra information                 | Mark | AO / Spec. Ref. |                            |   |  |                              |  |   |  |   |                |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|------|-----------------|----------------------------|---|--|------------------------------|--|---|--|---|----------------|
| <b>04.1</b>                       | <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Thick, waxy layer on leaf surface</td> <td></td> <td>✓</td> </tr> <tr> <td>Berries that are poisonous</td> <td>✓</td> <td></td> </tr> <tr> <td>Bark on trees that falls off</td> <td></td> <td>✓</td> </tr> </table> <p>all three rows correct = <b>2</b> marks<br/>two rows correct = <b>1</b> mark<br/>one row correct = <b>0</b> marks</p> | Thick, waxy layer on leaf surface |      | ✓               | Berries that are poisonous | ✓ |  | Bark on trees that falls off |  | ✓ |  | 2 | AO1<br>4.3.3.2 |
| Thick, waxy layer on leaf surface |                                                                                                                                                                                                                                                                                                                                                                                                                          | ✓                                 |      |                 |                            |   |  |                              |  |   |  |   |                |
| Berries that are poisonous        | ✓                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   |      |                 |                            |   |  |                              |  |   |  |   |                |
| Bark on trees that falls off      |                                                                                                                                                                                                                                                                                                                                                                                                                          | ✓                                 |      |                 |                            |   |  |                              |  |   |  |   |                |

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

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

| Question    | Answers                                                                                    | Extra information                                                            | Mark | AO / Spec. Ref. |
|-------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------|-----------------|
| <b>04.4</b> | genetic material / DNA / chromosomes is doubled / replicated / copied / duplicated         |                                                                              | 1    | AO1<br>4.1.2.2  |
|             | the (replicated) chromosomes are pulled / moved apart                                      | the (replicated) chromosomes are separated                                   | 1    |                 |
|             | cytoplasm divides into two (cells)<br><b>or</b><br>cell membrane divides to form two cells | allow two new nuclei form<br>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.           |
|-------------|-----------------|-----------------------|------|---------------------------|
| <b>04.5</b> | differentiation | ignore specialisation | 1    | AO1<br>4.1.2.3<br>4.1.1.4 |

|                         |  |           |
|-------------------------|--|-----------|
| <b>Total Question 4</b> |  | <b>14</b> |
|-------------------------|--|-----------|

## Question 5

| Question | Answers       | Extra information | Mark | AO / Spec. Ref.           |
|----------|---------------|-------------------|------|---------------------------|
| 05.1     | guard (cells) |                   | 1    | AO1<br>4.2.3.2<br>4.2.3.1 |

| Question | Answers                                                                                                                                                                                                                                                                                                                                                                                                            | Extra information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Mark | AO / Spec. Ref.           |
|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------|
| 05.2     | any <b>two</b> from: <ul style="list-style-type: none"> <li>• transpiration (stream) involves xylem <b>and</b> translocation involves phloem</li> <li>• transpiration (stream) transports water (and minerals / ions) <b>and</b> translocation transports (dissolved) sugars</li> <li>• transpiration (stream) moves substances upwards <b>and</b> translocation moves substances upwards and downwards</li> </ul> | allow transpiration (stream) involves dead cells <b>and</b> translocation involves living cells<br><br>allow transpiration (stream) transports water (and minerals / ions) <b>and</b> translocation transports (dissolved) sucrose<br><br>ignore glucose / ions / minerals in translocation<br><br>allow transpiration (stream) moves substances unidirectionally <b>and</b> translocation moves substances bidirectionally<br><br>allow transpiration (stream) does not require energy (to move substances) <b>and</b> translocation does (require energy to move substances) | 2    | AO1<br>4.2.3.1<br>4.2.3.2 |

| Question | Answers                | Extra information | Mark | AO / Spec. Ref. |
|----------|------------------------|-------------------|------|-----------------|
| 05.3     | warm with low humidity |                   | 1    | AO1<br>4.2.3.2  |

| Question    | Answers                                                                                   | Extra information                                                                               | Mark | AO / Spec. Ref.                      |
|-------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------|--------------------------------------|
| <b>05.4</b> | stomata (almost) closed at (mid)night because there is no / less light for photosynthesis | ignore values for time and width<br>ignore dark for no / less light                             | 1    | AO3<br>4.2.3.2<br>4.4.1.1<br>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.                      |
|-------------|---------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|------|--------------------------------------|
| <b>05.5</b> | stomata are open wider <b>and</b> for more time                     | allow descriptions of the area of open stomata for width                                             | 1    | AO3<br>4.2.3.2<br>4.4.1.1<br>4.4.1.2 |
|             | (so allows plant) to take in more carbon dioxide for photosynthesis | allow (so allows) plant to take in as much carbon dioxide as in normal conditions for photosynthesis | 1    |                                      |

|                         |  |           |
|-------------------------|--|-----------|
| <b>Total Question 5</b> |  | <b>10</b> |
|-------------------------|--|-----------|

## Question 6

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

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

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

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



| Question                | Answers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Mark      | AO / Spec. Ref.                      |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------------------------------|
| <b>06.5</b>             | <b>Level 2:</b> Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3–4       | AO1<br>4.1.3.1<br>4.1.3.3<br>4.2.2.2 |
|                         | <b>Level 1:</b> Facts, events or processes are identified and simply stated but their relevance is not clear.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1–2       |                                      |
|                         | <b>No relevant content</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0         |                                      |
|                         | <b>Indicative content</b> <ul style="list-style-type: none"> <li>• <b>both</b> have a large surface area                             <ul style="list-style-type: none"> <li>○ to maximise <u>diffusion</u></li> </ul> </li> <li>• <b>both</b> have thin walls <b>or</b> have walls that are one cell thick                             <ul style="list-style-type: none"> <li>○ to reduce diffusion distance / time</li> </ul> </li> <li>• <b>both</b> are in close proximity to blood supply                             <ul style="list-style-type: none"> <li>○ to reduce diffusion distance / time</li> </ul> </li> <li>• <b>both</b> have a good blood supply <b>or</b> both have a capillary network                             <ul style="list-style-type: none"> <li>○ to maintain concentration gradient</li> </ul> </li> <li>• villi have microvilli                             <ul style="list-style-type: none"> <li>○ to (further) increase surface area</li> </ul> </li> <li>• cells of villi contain many mitochondria                             <ul style="list-style-type: none"> <li>○ for active transport</li> </ul> </li> </ul> <p>For <b>Level 2</b> reference to functions of structural details of <b>both</b> alveoli and villi is required.</p> |           |                                      |
| <b>Total Question 6</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>14</b> |                                      |

Question 7

| Question | Answers                                                                                                                                  | Extra information                                                                                                                                                                               | Mark | AO / Spec. Ref.           |
|----------|------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------|
| 07.1     | any <b>one</b> from: <ul style="list-style-type: none"> <li>• sexual contact / intercourse</li> <li>• exchange of body fluids</li> </ul> | allow intercourse unqualified<br>ignore kissing<br>allow example of exchange such as (drug) users sharing needles <b>or</b> blood transfusion <b>or</b> passage from mother to foetus in uterus | 1    | AO1<br>4.3.1.1<br>4.3.1.2 |

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

| Question | Answers                                                                                                                                                                                                                                                                                                                                                                     | Extra information                                                                                                                                                                                                                                                                                 | Mark | AO / Spec. Ref. |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------|
| 07.3     | any <b>one</b> from: <ul style="list-style-type: none"> <li>• better education (into prevention of spread of HIV)</li> <li>• condoms more widely available <b>or</b> condoms easier to source <b>or</b> condoms cheaper</li> <li>• new / better drugs (to prevent HIV infection / spread)</li> <li>• better / more testing / identification (of people with HIV)</li> </ul> | allow increased awareness about HIV<br><br>ignore contraception / protection unqualified<br><br>allow PrEP / anti- <u>retrovirals</u> stop the virus being passed on<br><br>ignore new treatments<br>do <b>not</b> accept antibiotics<br><br><br>allow less promiscuity<br><br>ignore vaccination | 1    | AO3<br>4.3.1.2  |

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

| Question | Answers                                                                                                                                           | Extra information                                                                 | Mark | AO / Spec. Ref. |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|-----------------|
| 07.5     | any <b>one</b> from: <ul style="list-style-type: none"> <li>• calculate as a percentage</li> <li>• give the numbers per 100 000 people</li> </ul> | ignore calculate as a proportion<br>allow any standard number eg<br>10 000 / 1000 | 1    | AO3<br>4.3.1.2  |

| Question | Answers                                                                   | Extra information                                                                                                                                                                                        | Mark | AO / Spec. Ref.                      |
|----------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------|
| 07.6     | inactive HIV / virus is injected (into bloodstream / muscle / body)       | ignore reference to WBC unqualified<br><br>allow dead HIV / virus is injected (into bloodstream / muscle / body)<br><br>allow (named) part of HIV / virus is injected (into bloodstream / muscle / body) | 1    | AO1<br>4.3.1.7<br>4.3.1.6<br>4.3.1.2 |
|          | white bloods cells produce antibodies (against inactive virus)            | allow lymphocytes produce antibodies (against inactive virus)<br>do <b>not</b> 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.        |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|------------------------|
| <p><b>07.7</b></p> | <p>HIV / antigen / protein injected into mouse</p> <p>extract / collect (mouse) lymphocytes that make a specific antibody to HIV / antigen / protein</p> <p>lymphocytes are combined with a tumour cell to create a <u>hybridoma</u></p> <p>(hybridoma) <u>cloned</u> to create many cells that produce the antibody</p> | <p>allow other correct small mammals eg rat</p> <p>allow extract specific lymphocytes from someone with HIV for <b>2</b> marks</p> <p>allow lymphocytes are combined with a myeloma / cancer cell to create a <u>hybridoma</u></p> <p><b>alternative route</b></p> <p>HIV / antigen / protein injected into mouse (1)</p> <p>lymphocytes from mouse are combined with a tumour cell to create a <u>hybridoma</u> (1)</p> <p>the hybridoma that makes the specific / correct antibody is isolated (1)</p> <p>(hybridoma) <u>cloned</u> to create many cells that produce the antibody (1)</p> | <p>1</p> <p>1</p> <p>1</p> <p>1</p> | <p>AO1<br/>4.3.2.1</p> |

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