# Markscheme

## May 2019

## Biology

## On-screen examination

The following are the annotations available to use when marking responses.

| Annotation | Explanation |
|---|---|
|  | Correct point, place at the point in the response where it is clear that the candidate deserves the mark. For use in analytically marked questions only. |
|  | Omission, incomplete |
| CON | Contradiction |
|  | Valid part (to be used when more than one element is required to gain the mark) |
|  | Error carried forward |
|  | Dynamic annotation, it can be expanded to surround work |
|  | Horizontal wavy line that can be expanded |
|  | Highlight tool that can be expanded to mark an area of a response |

| Annotation | Explanation |
|---|---|
|  | Not good enough |
|  | The candidate has given a response but it is not worthy of any marks |
|  | Test box used for additional marking comments |
|  | Seen; must be stamped on all blank response areas and on duplicate pages of concatenated responses |
|  | Vertical wavy line that can be expanded |
|  | Words to that effect |
|  | Award 1, 2, 3, 4 marks. For use in holistically marked questions only |

**Markscheme instructions**

**1** Mark positively. Give candidates credit for what they have achieved and what is correct. Do not deduct marks for incorrect responses.

**2** Follow the markscheme provided and award only whole marks.

**3** Each marking point appears on a separate line.

**4** The maximum mark for each subpart is indicated in the "Total" column.

**5** Where a mark is awarded a tick should be placed in the text at the precise point where it is clear the candidate deserves the mark.

**6** Each marking point in a question part should be awarded separately unless there is an instruction to the contrary in the Notes column.

**7** A question subpart may have more marking points than the total allows. This will be indicated by the word "***max***" in the Answer column. Further guidance may be given in the Notes column.

**8** Additional instructions on how to interpret the markscheme are in bold italic text in the Answer column.

**9** Alternative wording may be indicated in the Answer column by a slash (/). Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.

**10** Alternative answers are indicated in the Answer column by "***or***". Either alternative is equally acceptable but the candidate cannot be rewarded for both as they are associated with the same marking point.

**11** If two related points are required to award a mark, this is indicated by "***and***" in the answer column.

**12** Words in brackets ( ) in the Answer column are not necessary to gain the mark.

**13** Words that are <u>underlined</u> are essential for the mark.

**14** In some questions a reverse argument is also acceptable. This is indicated by the abbreviation *ORA (or reverse argument)* in the Notes column. Candidates should not be rewarded for reverse arguments unless *ORA* is given in the Notes column.

**15** If the candidate's response has the same meaning or is clearly equivalent to the expected answer the mark should be awarded. In some questions this is emphasized by the abbreviation *WTTE (or words to that effect)* in the Notes column.

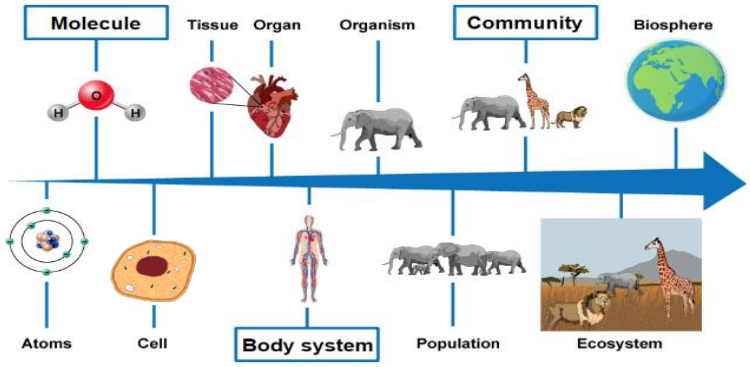
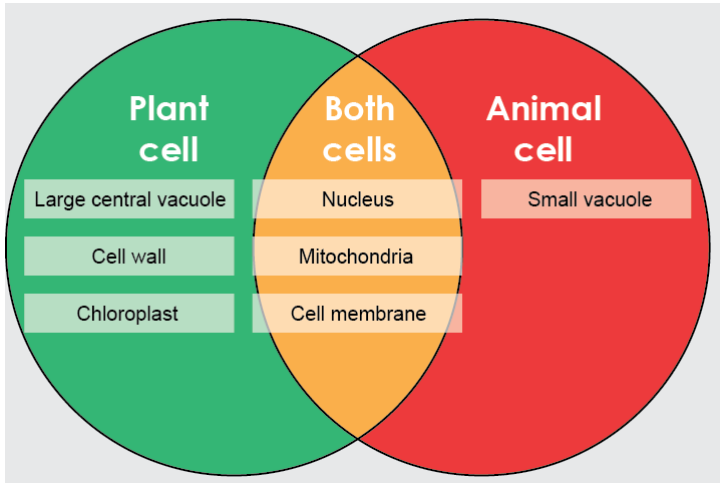
**16** When incorrect answers are used correctly in subsequent question parts the follow through rule applies. Award the mark and add ECF (error carried forward) to the candidate response.

**17** The order of marking points does not have to be the same as in the Answer column unless stated otherwise.

**18** Marks should not be awarded where there is a contradiction in an answer. Add CON to the candidate response at the point where the contradiction is made.

**19** Do not penalize candidates for errors in units or significant figures unless there is specific guidance in the Notes column.

**20** Questions with higher mark allocations will generally be assessed using a level response method using task specific clarifications developed with reference to the criteria level descriptors. A candidate's work should be reviewed to determine holistically the mark for each row of the holistic grid and a mark awarded for each row.

| Question | | Answers | Notes | Total | Criterion |
|---|---|---|---|---|---|
| 1 | a |  <br>All correct | | 1 | A |
| | b |  <br>One correct term in each zone<br><br>All correct | *Award marks separately* | 2 | A |

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|---|---|---|---|---|---|
| | c | (Function of mitochondria is to) convert ***or*** produce energy ***or*** produce ATP<br><br>(From a) source of energy<br><br>***Correct use of one of the following terms: (1 max)***<br>• respiration<br>• ATP<br>• glucose | *WTTE*<br>*Accept powerhouse*<br>*Do **not** accept storage of energy*<br><br>*For example, accept glucose, protein, sugar, food*<br>*Do **not** accept a general reference to a substance or "calories"* | **3** | A |
| | d | (Folds give) increase in (surface) area<br><br>More sites for reactions (energy production) to take place | <br><br>*WTTE*<br>*Do **not** accept exchange of materials* | **2** | A |
| **2** | a | Growth ***and*** repair ***and*** asexual reproduction | *Do **not** award a mark if more than these three are selected* | **1** | A |
| | b | ***Each pair of statements is listed in the order meiosis and mitosis***<br>***Any two points from the following list only (2 max)***<br>• haploid ***and*** diploid ***or*** 23 ***and*** 46 chromosomes<br>• 4 cells ***and*** 2 cells<br>• (genetically) non-identical ***and*** (genetically) identical<br>• gametes (sex cells) ***and*** somatic cells | *WTTE*<br>*Accept half the number of chromosomes compared to the parent*<br>*Both statements must be explicitly stated* | **2** | A |
| | c | ***Statement of two sources (2 max):***<br>• sexual reproduction / two parents<br>• mutation<br>• crossing over<br>• random assortment<br>• arrival of new individuals<br><br>***Correctly linked statement of how the variation occurs in that source, for example (2 max):***<br>• new combination of genes from two individuals<br>• change in DNA sequence resulting from external event<br>• exchange of small segments DNA within a chromosome<br>• new combination of chromosomes<br>• new traits brought from a different gene pool | *Award mark for statement of source even if link to variation is not correct* | **4** | A |

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| **3** | a | Disappearance of a species ***and*** disappearance of many species<br><br>A correct use of the word "<u>species</u>" | *WTTE*<br>*Accept population for the first marking point only*<br><br>*Only award the second mark if the first is awarded.* | **2** | A |
| | b | ***One example of a change, for example (1 max):***<br>• increased predation<br>• habitat reduction<br>• decreased food supply<br>• increased competition<br>• disease<br>• natural disaster<br>• a specific example of human interference<br><br>***Correct justification, for example:***<br>• eaten before they reproduce<br>• insufficient resources for shelter ***or*** camouflage<br>• unlikely to be healthy enough to reproduce<br>• decreased availability of resources<br>• large scale death<br>• any direct link to human interference | *Do **not** award two marks for two examples*<br><br>*Two marks can be awarded for two correct justifications* | **2** | A |
| | c | ***Any two points, for example (2 max):***<br>• fur (for warmth)<br>• insulating layer (for warmth)<br>• warm-blooded (control their temperature)<br>• carry their young ***or*** high level of parental care ***or*** give birth to live young<br>• mothers feed their young | *WTTE* | **2** | A |
| | d | ***Any four of the following points (4 max):***<br>• rabbits are more likely to survive when fur colour matches location (as they are not found easily by predators)<br>• longer survival means greater chance of reproduction<br>• concentration of fur types by location means breeding more likely between similar types<br>• offspring are more likely to have advantageous fur colour<br>• offspring born with disadvantageous fur type less likely to survive | *WTTE* | **4** | A |

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| **4** | a | **Biotic:** fungi ***and*** microbes<br><br>***and***<br><br>**Abiotic**: water | *Accept soil in either list* | **1** | A |
| | b | Water<br><br>Glucose | | **2** | A |
| | c | Presence of fertilizer | *WTTE* | **1** | B |
| | d | Height ***or*** colour of leaves ***or*** leaf appearance | *WTTE*<br>*Do **not** accept growth* | **1** | B |
| | e | **Quantitative data**: numerical ***or*** states example<br><br>**Qualitative data**: non-numerical ***or*** descriptive ***or*** states example | | **2** | B |
| | f | 329.66666667<br><br>330 | *Accept 329.6(66…) or 329.7 or print of calculator display*<br><br>*Award **(2 marks)** if only this number is seen* | **2** | C |
| | g | **Strength:** three trials ***or*** both quantitative and qualitative data recorded<br><br>**Limitation:** limited range ***or*** two values of IV only ***or*** specific reference to lack of control variables | *Accept two types of data*<br><br>*Do **not** accept general refs to CV*<br>*Do **not** accept only three trials as a limitation* | **2** | C |

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<tr>
<td>5</td>
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<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>5 1.V<br><br>(Identification of variables)</td><td>Some variables are referred to that are connected to the problem but these may not be explicitly identified</td><td>Independent<br>or<br>one control variable is identified</td><td>Independent variable<br>and<br>one control variable are identified</td><td>Independent<br>and<br>at least two control variables are identified</td></tr>
<tr><td>5 2.H<br><br>(Hypothesis)</td><td>Formulates a hypothesis connected to the variables but not explicitly linked to growth, number of plants or rate of growth</td><td>Formulate a testable hypothesis correctly linked to the growth, number of plants or rate of growth (no explanation)</td><td>Formulate a testable hypothesis correctly linked to the growth, number of plants or rate of growth with correct scientific explanation</td><td></td></tr>
<tr><td>5 3.M<br><br>(Manipulation of variables/ description of method)</td><td>Attempt at a method but detail is insufficient for manipulation of variables</td><td>Partial method is described with detail sufficient for<br>IV<br>and<br>DV only</td><td>Partial method is described with detail sufficient for IV<br>and<br>DV<br>and<br>one CV</td><td>Method is described with detail sufficient for<br>IV<br>and<br>DV<br>and<br>two CV</td></tr>
<tr><td>5 4.D<br><br>(Collection of data)</td><td>Plans to repeat at least three groups of duckweed<br>or<br>measures for at least five different light conditions</td><td>Plans to repeat at least three groups of duckweed<br>and<br>measures for at least five different light conditions</td><td></td><td></td></tr>
<tr><td>5 5.S<br><br>(Safety)</td><td>Any relevant comment relating to safety</td><td></td><td></td><td></td></tr>
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<td>14</td>
<td>B</td>
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| | | | | | |
|---|---|---|---|---|---|
| **6** | a | 1. Collect duckweed plants from pond<br>2. Select equally healthy duckweed plants<br>3. Label beakers<br>4. Measure water from pond into each 500 $cm^3$ beaker<br>5. Count initial duckweed plants and place 10 duckweed plants into each of 24 beakers<br>6. Set the temperature of each water bath<br>7. Add thermometer to water bath<br>8. Place lamp facing water bath<br>9. Place three beakers with samples into each water bath<br>10. Wait two weeks<br>11. Count final number of duckweed plants and record values<br><br>First mark for one label in correct location<br><br>Second mark for all labels in correct location | | **2** | B |
| | b | ***Either add detail to an existing step or specify a control, for example (1 max):***<br>• measure volume of water<br>• place the lamp at a fixed distance<br>• set the temperature at evenly spaced increments<br>***or***<br>***add an extra step, for example (1 max):***<br>• stir the pond water before adding the duckweed<br>• allow for time for the temperature in the beaker to reach the temperature in the water bath<br><br>***Correctly linked justification to improvement, for example (1 max):***<br>• ensures constant value of a control variable<br>• the light level is constant<br>• ensures nutrients are equally distributed<br>• duckweed experience constant temperature | *Do **not** accept more trials or shorter temperature increments* | **2** | C |

<table>
<tr>
<td></td>
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<table>
<tr><th>Temperature / °C</th><th>Mean number of plants</th></tr>
<tr><td>7.5</td><td>20</td></tr>
<tr><td>10.0</td><td>28</td></tr>
<tr><td>12.5</td><td>40</td></tr>
<tr><td>15.0</td><td>50</td></tr>
<tr><td>20.0</td><td>70</td></tr>
<tr><td>27.5</td><td>80</td></tr>
<tr><td>30.0</td><td>70</td></tr>
<tr><td>37.5</td><td>18</td></tr>
</table>
<br>temperature on the x axis<br><br>mean number of plants on y axis<br><br>°C included on x axis<br><br>evenly numbered intervals on both axes<br><br>two points plotted correctly (± 1 unit)<br><br>all points plotted correctly (± 1 unit)
</td>
<td>Accept (degrees) Celsius, C°, (degrees) centigrade</td>
<td>6</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>d</td>
<td>
Trend, any three points (3 max):
<ul>
<li>below 27.5 (°C) the rate of photosynthesis or growth increases with temperature</li>
<li>max rate is at a temp of 27.5 (°C)</li>
<li>after 27.5 (°C) the rate decreases</li>
<li>general description of the trend without values for example the graph is asymmetrical or increases gradually before max and decreases rapidly after the max</li>
</ul>
Explanation, any two reasonable points, for example (2 max):
<ul>
<li>photosynthesis or growth or mitosis increases with temperature controlled by enzymes</li>
<li>chemical reactions increase with temperature</li>
<li>enzymes denature at temp higher than 27.5 (°C)</li>
<li>at higher temp, water is lost through evaporation and this affects availability of water</li>
</ul>
</td>
<td>ECF from the graph in part c<br>WTTE</td>
<td>5</td>
<td>C</td>
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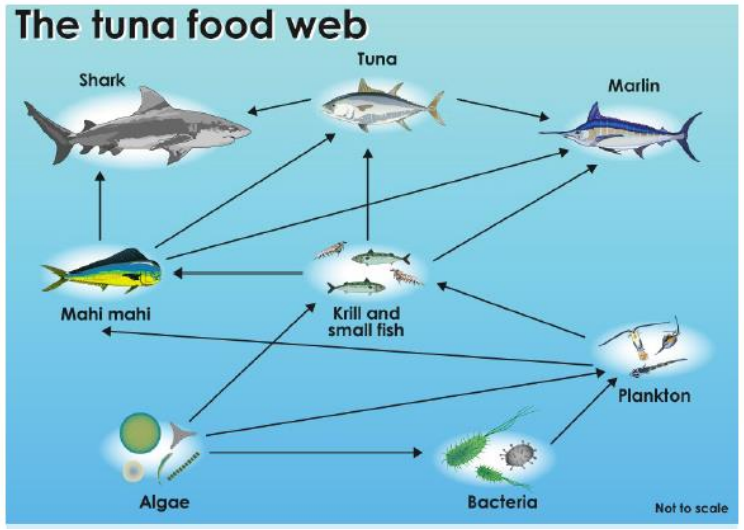
| | | | | | |
|---|---|---|---|---|---|
| | e | Below 27.5 (°C) the increase was proportional ***or*** at the lower temperatures the increase was proportional<br><br>Above 27.5 (°C) there was a decrease ***or*** the increase was not proportional over the full temperature range<br><br>The prediction is not supported by the data ***or*** partially supported by the data | *Values are not needed if trends are described correctly*<br><br>*WTTE, do **not** award the third mark unless at least one of the other marks is awarded.* | **3** | C |
| **7** | a | If we add water hyacinth to waste water<br><br>Then there will be a decrease in a (named) contaminant<br><br>Because (scientifically correct use of information from the table)<br>eg water hyacinth has been shown to uptake ***or*** store ***or*** remove ***or*** absorb nitrogen ***or*** lead | | **3** | B |
| | b | ***Accept any two reasonable suggestions, for example (2 max):***<br>• temperature<br>• size of test pond/container<br>• contaminants<br>• light | *Do **not** accept anything related to plants as it is the IV* | **2** | B |
| | c | Poor control of variables, invalid results<br><br>Different amounts of nitrogen could lead to different growth rates of the water hyacinth<br>***or***<br>The starting point of nitrogen concentration is not the same so the final difference may not be due to the water hyacinth | | **2** | C |
| | d | Use a known amount of nitrogen each trial<br>***or***<br>Measure the amount of nitrogen at the beginning (so percent change could be calculated) | | **1** | C |

| | | | | | |
|---|---|---|---|---|---|
| **8** | a | ***Accept any reasonable suggestion, for example (1 max):***<br>• over fishing<br>• habitat loss<br>• pollution<br>• increased fish consumption (from human population increase) | | **1** | D |
| | b | ***Accept any two reasonable suggestions, for example (2 max):***<br>• sonar has helped fishermen locate fish<br>• (sonar can therefore) allow fishermen to catch more fish<br>• larger boats have allowed fishermen to catch more fish at one time<br>• GPS has allowed boats to be more accurate at locating fishing areas and tracking fish<br>• Technical use of larger nets such as trawling or dredging or new materials | *Accept radar*<br><br>*Do **not** accept bigger nets alone* | **2** | D |

| | | | | | |
|---|---|---|---|---|---|
| | c |  <br><br>***Identifies the change in an organism if the number of tuna changes, for example (2 max):***<br>• shark population reduced<br>• mahi mahi population increases<br>• mahi mahi population decreases<br><br>***Correctly linked justification for change, for example (2 max):***<br>• because less food for sharks<br>• because there are fewer tuna to eat the mahi mahi<br>• sharks have to eat mahi mahi rather than tuna<br><br>***A correct use of ecologic terminology, for example (1 max):***<br>• predator<br>• prey<br>• trophic level<br>• consumer<br>• producer<br>• herbivore<br>• carnivore<br>• omnivore<br>• species<br>• population | *Refer to food web for other examples of possible changes*<br><br>*Change must be clearly stated not just implied*<br><br>*Do **not** accept food web, organism, or ecosystem* | **5** | D |

<table>
<tr>
<td>9</td>
<td>a</td>
<td>An advantage, for example (1 max):<br>• fish grow faster so reach market sooner<br>• provides more kg of fish<br>• less feed required to feed fish<br><br>A disadvantage, for example (1 max):<br>• potentially more expensive<br>• people may not want to buy GM fish<br>• do not know the impact of GM organisms on ecosystem</td>
<td>Do not accept GMOs are not good for human health</td>
<td>2</td>
<td>D</td>
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<td>b</td>
<td colspan="2">
<table>
<tr><th></th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>1. Env<br><br>(Environmental Impact)</td><td>States a positive or negative environmental impact</td><td>States a positive and negative environmental impact<br>or<br>states a positive or negative environmental impact with justification</td><td>States positive and negative environmental impact with justification for one of these</td><td>States positive and negative environmental impact with justification for both of these</td></tr>
<tr><td>2. Soc/eco<br><br>(Social or economic Impacts)</td><td>States a positive or negative social or economic impact</td><td>States a positive and negative social or economic impact<br>or<br>states a positive or negative social or economic impact with justification</td><td>States positive and negative social or economic impact with justification for one of these</td><td>States positive and negative social or economic impact with justification for both of these</td></tr>
<tr><td>3. L<br><br>(Location)</td><td>States a reasonable location</td><td>States a reasonable location and attempts to justify this using science</td><td>States a reasonable location and justifies this using detailed science</td><td></td></tr>
<tr><td>4. A<br><br>(Concluding appraisal)</td><td>Attempts a concluding appraisal</td><td>Gives a concluding appraisal with opinion in general terms</td><td>Gives a concluding appraisal with opinion that includes specific detail</td><td></td></tr>
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<td>14</td>
<td>D</td>
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