



National  
Qualifications  
2018

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**2018 Biology**

**Higher**

**Finalised Marking Instructions**

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## General marking principles for Higher Biology

*This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.*

- (a) Marks for each candidate response must **always** be assigned in line with these general marking principles and the detailed marking instructions for this assessment.
- (b) Marking should always be positive. Marks should be awarded for what is correct and not deducted for errors or omissions.
- (c) If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you should seek guidance from your team leader.
- (d) There are no half marks awarded.
- (e) Where a candidate makes an error in the first part of a question, credit should normally be given for subsequent answers that are correct with regard to this original error. Candidates should not be penalised more than once for the same error.
- (f) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including units, if appropriate) on its own.
- (g) Bulleted lists should not be used for extended response questions. Candidates must respond to the “command” word as appropriate and write extended answers in order to communicate fully their knowledge and understanding. Candidate responses in the form of bulleted lists may not be able to access the full range of available marks.
- (h) In the detailed marking instructions, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.
- (i) In the detailed marking instructions, words separated by / are **alternatives**.
- (j) A correct answer can be negated if:
  - an extra, incorrect, response is given
  - additional information that contradicts the correct response is included.
- (k) Where the candidate is instructed to choose one question to answer but instead answers both questions, both responses should be marked and the better mark awarded.
- (l) Unless otherwise required by the question, use of abbreviations (eg DNA, ATP) or chemical formulae (eg CO<sub>2</sub>, H<sub>2</sub>O) are acceptable alternatives to naming.
- (m) If a numerical answer is required and units are not given in the stem of the question or in the answer space, candidates must supply the units to gain the mark. If units are required on more than one occasion, candidates should not be penalised repeatedly.
- (n) Incorrect spelling is given. Sound out the word(s).
  - If the correct word is recognisable then give the mark.
  - If the word can easily be confused with another biological term then **do not** give the mark eg glucagon and glycogen.

**(o) Presentation of data:**

- If a candidate provides two graphs, in response to one question, mark both and give the higher score.
- If a question asks for a particular type of graph/chart and the wrong type is given, then full marks cannot be awarded. Candidates cannot achieve the plot mark but **may** be able to achieve the mark for scale and label. If the x and y data are transposed, then do not give the scale and label mark.
- If the graph uses less than 50% of the axes then do not give the scale and label mark.
- If 0 is plotted when no data for this is given, then do not give the plot mark (ie candidates should only plot the data given).

**(p) Marks are awarded only for a valid response to the question asked. For example, in response to questions that ask candidate to:**

- **identify, name, give or state**, they need only answer or present in brief form;
- **describe**, they must provide a statement as opposed to simply one word;
- **explain**, they must provide a reason for the information given;
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between topics being examined;
- **calculate**, they must determine a number from given facts, figures or information;
- **predict**, they must indicate what may happen based on available information;
- **suggest**, they must apply their knowledge and understanding to a new situation.

## Marking instructions for each question

### Section 1

| Question | Answer | Mark |
|----------|--------|------|
| 1.       | B      | 1    |
| 2.       | D      | 1    |
| 3.       | A      | 1    |
| 4.       | C      | 1    |
| 5.       | D      | 1    |
| 6.       | C      | 1    |
| 7.       | C      | 1    |
| 8.       | A      | 1    |
| 9.       | B      | 1    |
| 10.      | C      | 1    |
| 11.      | B      | 1    |
| 12.      | A      | 1    |
| 13.      | D      | 1    |
| 14.      | B      | 1    |
| 15.      | A      | 1    |
| 16.      | B      | 1    |
| 17.      | D      | 1    |
| 18.      | C      | 1    |
| 19.      | A      | 1    |
| 20.      | D      | 1    |

Section 2

| Question |     |       | Expected response  | Max mark | Additional guidance  |
|----------|-----|-------|--|----------|--|
| 1.       | (a) | (i)   | Negative feedback (control)/ homeostasis.  | 1        | <b>Not</b> - Negative control.   |
|          |     | (ii)  | Hypothalamus.  | 1        | Accept hypothalamus.<br><b>NOT</b> - Hypothalus.   |
|          |     | (iii) | Nerves/neurons/nerve impulses/electrical impulses/through nerves.  | 1        | <b>NOT</b> - Central nervous system<br>Additional incorrect answers negates<br><b>eg</b> Hormones/nerve receptors  |
|          | (b) | (i)   | Blood vessels/arterioles narrow.<br><br><b>OR</b><br><br>Vasoconstriction/blood vessels constrict.<br><br><b>OR</b><br><br>Muscles contract. | 1        | Additional physiological responses negate;<br><b>eg</b> Hairs standing on end/shivering.   |
|          |     | (ii)  | Less blood flow to the <u>skin</u> so less heat lost.  |          | <b>NOT</b> - "Less heat lost (by radiation)" alone.<br><br><b>NOT</b> - Stops/prevents heat loss.<br><br><b>NOT</b> - Stops/prevents blood flow to the skin. |

| Question |     | Expected response  | Max mark | Additional guidance  |
|----------|-----|--|----------|--|
| 1.       | (c) | <p>So enzymes work fastest/faster.</p> <p><b>OR</b></p> <p>So enzymes are at their optimum (temperature).</p> <p><b>OR</b></p> <p>Enzymes work too slowly when temperature is too low.</p> <p><b>OR</b></p> <p>Optimal/faster diffusion rates.</p> | 1        | <p><b>NOT</b> - “Enzymes have an optimum temperature” alone.</p> <p><b>NOT</b> - “So enzymes do not denature”.</p> |

| Question |     | Expected response  | Max mark | Additional guidance  |
|----------|-----|--|----------|--|
| 2.       | (a) | 2·2  | 1        |  |
|          | (b) | As temperature increased heart rate increased.   | 1        | <b>NOT</b> - The heart rate is dependent upon the temperature of the water.<br><br>Direction must be indicated.<br><br><b>NOT</b> - As heart rate increases temperature increases. |
|          | (c) | Increased/optimum enzyme activity/oxygen delivery. (1)<br><br><b>Leading to</b><br><br>increased respiration/ATP production. (1)<br><br><b>OR</b><br><br>Increased diffusion (1)<br><br><b>Leading to</b><br><br>increased supply of oxygen/glucose/substrates/metabolites (1) | 2        |  |
|          | (d) | Behavioural (response).  | 1        | <b>NOT</b> - Examples alone.   |

| Question |     |      | Expected response   | Max mark | Additional guidance   |
|----------|-----|------|---|----------|---|
| 3.       | (a) | (i)  | Stationary  | 1        |   |
|          |     | (ii) | Reduces/eliminates/prevents/competition.<br><br>OR<br><br>Allows it to out-compete other bacteria/micro-organisms.<br><br>OR<br><br>Kills other bacteria/micro-organisms which might damage the plant thereby affecting/reducing <i>Streptomyces</i> food supply. | 1        | <b>NOT</b> - “Kills other bacteria/micro-organisms” alone.  |
|          | (b) | (i)  | The microorganisms can use/the carbohydrates for energy/food/respiration/nutrients/growth.<br><br>OR<br><br>They can feed on the carbohydrates.   | 1        | <b>NOT</b> - “Use/get nutrients from the plant” alone.<br><br><b>NOT</b> - Eat carbohydrates  |
|          |     | (ii) | The plant/it is protected from pathogens/diseases/bacteria/micro-organisms.<br><br>OR<br><br>Kills other bacteria/micro-organisms that might harm the plant/it.   | 1        | <b>NOT</b> - “Kills other bacteria/micro-organisms” alone.  |
|          | (c) | (i)  | Fusidic acid/gentamycin.  | 1        |   |
|          |     | (ii) | Streptomycin is less effective than fusidic acid/gentamycin/others of the same concentration.   | 1        | Streptomycin <b>must</b> be mentioned to gain the mark.<br><br>Survival of bacteria is not equivalent to effectiveness of antibiotic.<br><br>Conclusion must relate to aim. |



| Question |     | Expected response  | Max mark | Additional guidance   |
|----------|-----|--|----------|---|
| 4.       | (a) | <p>Advantage - to avoid adverse conditions/metabolic adversity/lack of food.</p> <p><b>OR</b></p> <p>More food available. (1)</p> <p>Disadvantage - /uses energy/metabolic cost. (1)</p> | 2        | <b>NOT</b> - "Harsh/cold weather/temperature" alone without a link to metabolism. |
|          | (b) | <p>Each generation dies after laying eggs.</p> <p><b>OR</b></p> <p>Only one/4<sup>th</sup> generation migrates.</p>  | 1        |   |
|          | (c) | (Daily) torpor.  | 1        |   |

| Question |     |       | Expected response   | Max mark | Additional guidance   |
|----------|-----|-------|---|----------|---|
| 5.       | (a) | (i)   | Restriction endonuclease - EcoR1.<br>(1)<br><br>Reason -<br>Complementary/same/matching sticky ends.<br><br>OR<br><br>Complementary bases/base pairs/DNA sequence.<br>(1) | 2        | <b>NOT</b> - So that it can be inserted into the plasmid.         |
|          |     | (ii)  | (DNA) ligase.   | 1        |   |
|          |     | (iii) | 50  | 1        |   |
|          | (b) |       | Origin of replication/replication origin/ORI.   | 1        | <b>NOT</b> - Replication site (does not negate correct response). |

| Question |     |       | Expected response  | Max mark | Additional guidance   |
|----------|-----|-------|--|----------|---|
| 6.       | (a) | (i)   | <p>(The number of breeding pairs) rises/increases from 0.2 (breeding pairs)/km<sup>2</sup> in March 2011 to 1.6 in June 2011. (1)</p> <p>(The number of breeding pairs) then drops to 0.4 in March 2012. (1)</p>   | 2        | <p>Cannot access any marks unless <b>June 2011 and 1.6</b> are mentioned.</p> <p>Accept 11 or 12 as equivalent to 2011 and 2012.</p> <p>km<sup>2</sup> not equivalent to /km<sup>2</sup></p> <p>Do not penalise for additional months between March 2011 and March 2012, if figures are correct.</p> <p>If grey described correctly and red squirrel data also used = <b>1 mark.</b></p> <p>Correct values with no units = <b>1 mark.</b></p> |
|          |     | (ii)  | 33   | 1        |   |
|          |     | (iii) | 1:4  | 1        |   |
|          | (b) | (i)   | <p>The same animal may have been counted more than once.</p> <p><b>OR</b></p> <p>Not every animal passes a camera.</p> <p><b>OR</b></p> <p>Too few cameras/ cameras only record animals in some parts of the area.</p> <p><b>OR</b></p> <p>Equipment failure or description.</p> | 1        | <b>NOT</b> - Triggered by other animals   |

| Question |     |      | Expected response  | Max mark | Additional guidance |
|----------|-----|------|--|----------|---------------------|
| 6.       | (b) | (ii) | <p>1. When the pine marten/predator number is high/more/45 <b>OR</b> in wooded area 1.</p> <p><b>AND</b></p> <p>There are more red (squirrels) than grey (squirrels). (1)</p> <p>2. When pine marten/predator numbers are low/less/12 <b>OR</b> in wooded area 2.</p> <p><b>AND</b></p> <p>There are more grey (squirrels) than red (squirrels). (1)</p> | 2        |                     |
|          | (c) |      | Invasive (species).  | 1        |                     |

| Question |     |       | Expected response  | Max mark | Additional guidance  |
|----------|-----|-------|--|----------|--|
| 7.       | (a) | (i)   | Treated (plants) have higher/greater absorption (of light) between 450-600 (nm) or converse.   | 1        | Do not negate for stays the same 350-450 and 600-700 (nm).                         |
|          |     | (ii)  | Treated plants have a higher carotenoid content/more carotenoid pigments.  | 1        | <b>NOT</b> - Accessory pigments.<br><b>NOT</b> - Greater number(s) of carotenoids. |
|          |     | (iii) | Generate/converted to ATP.<br><b>OR</b><br>Produces hydrogen/H.<br><b>OR</b><br>Used for photolysis/to split water.<br><b>OR</b><br>Excite electrons/increase energy levels of electrons.<br><b>OR</b><br>Energy used to pump hydrogen ions across membrane. | 1        | <b>NOT</b> - To make chemical energy/glucose.                                      |
|          | (b) |       | More photosynthesis. (1)<br><br>More energy/glucose for growth/oil (production)/seed (production). (1)   | 2        |  |

| Question |     |      | Expected response   | Max mark | Additional guidance   |
|----------|-----|------|---|----------|---|
| 8.       | (a) | (i)  | 200   | 1        |   |
|          |     | (ii) | 5000000/5 million   | 1        |   |
|          | (b) | (i)  | Food security   | 1        |   |
|          |     | (ii) | <p>Less energy lost/more energy in anchovies as there are fewer/less trophic levels.</p> <p><b>OR</b></p> <p>Less energy in salmon as they are at a higher trophic level.</p> | 1        | <p><b>NOT</b> - Less energy lost between/in trophic levels.</p> <p>A comparison is required to access the mark.</p> |

| Question |     | Expected response   | Max mark  | Additional guidance   |  |
|----------|-----|---|---|---|--|
| 9.       | (a) | <p>Crossbreeds/F<sub>1</sub>/offspring/lambs may have improved characteristics/traits/genes.</p> <p><b>OR</b></p> <p>To get the best characteristics/traits/genes from both (breeds).</p> <p><b>OR</b></p> <p>To introduce (new)/(desirable) characteristics/traits/genes.</p> <p><b>OR</b></p> <p>Produce hybrid vigour.</p> | 1   | <p><b>NOT</b> - Answer suggesting two different species.</p> <p><b>NOT</b> - To get the best of both breeds (as no mention of characteristics/trait).</p> |  |
|          | (b) | <p>Greater/increased (genetic) variation/variety (in F<sub>2</sub>/offspring).</p> <p><b>OR</b></p> <p>Not all offspring will show desired characteristics.</p>   | 1   |   |  |
|          | (c) | (i)   | Test (cross)  | 1   | <b>NOT</b> - Back cross  |
|          |     | (ii)  | All/ higher chance of lambs/F <sub>2</sub> /offspring have (desired/dominant) characteristic/allele/dominant gene.  | 1   | <b>NOT</b> - "So desired trait is ensured" alone (as offspring is not indicated).                                    |
|          | (d) |   | <p>(Inbreeding) results in the build-up/accumulation of (recessive/deleterious) homozygous alleles</p> <p><b>OR</b></p> <p>results in inbreeding depression</p> | 1   | <b>NOT</b> - "There is a build-up/accumulation of recessive deleterious alleles" alone (as no mention of homozygous) |

| Question |     |       | Expected response  | Max mark | Additional guidance  |
|----------|-----|-------|--|----------|--|
| 10.      | (a) | (i)   | Any TWO from:<br><br>Size/mass/of muscle (tissue)/ sample.<br><br>Type of muscle tissue/age of fish.<br><br>Temperature/pH/time.<br><br>Volume/concentration/type of solution.   | 2        | <b>NOT</b> - Volume of muscle (tissue).<br><br><b>NOT</b> - Mass/species of fish.<br><br><b>NOT</b> - Same solution.<br><br><b>NOT</b> - "Concentration"/"Volume" alone.<br><br>Additional incorrect variables (e.g. Light intensity/ oxygen concentration/ CO2 concentration) negates 1 mark. |
|          |     | (ii)  | Hydrogen/ionic/disulphide/Van der Waals/hydrophobic/covalent.  | 1        | <b>NOT</b> - Peptide (negates correct answer).   |
|          | (b) | (i)   | Correct scales (0-110 kDa and 0-50 mm) and label. (1)<br><br>Correctly plotted. (1)  | 2        | If axes transposed scales and labels mark not awarded.   |
|          |     | (ii)  | 32 kDa or whatever plotted graph shows.  | 1        |  |
|          |     | (iii) | 550  | 1        |  |
|          | (b) | (iv)  | 1, 2 and 4 each have three bands/proteins in common/at the same distance <b>AND</b> 3 only has one band in common with the other three species.<br><br><b>OR</b><br><br>They/1, 2 and 4 have more bands/proteins in common/the same/similar or converse. | 1        | <b>NOT</b> - Proteins 1, 2 and 4 all have band X.  |



| Question |   | Expected response  | Max mark | Additional guidance |
|----------|---|--|----------|---------------------|
| 11.      | A | <ol style="list-style-type: none"> <li>1. (Measured) in terms of species, genetic and ecosystem diversity.<br/>(any 2)</li> <li>2. A third example from point 1.</li> <li>3. Species diversity is species richness and relative abundance/proportion of each species.</li> <li>4. Species richness is the number of different species.</li> <li>5. Genetic diversity is number and frequency of (different) alleles in a population/species.</li> <li>6. Ecosystem diversity is the number of (distinct) ecosystems in an area/environment.<br/>(any 4)</li> </ol>   | 4        |                     |
| 11.      | B | <ol style="list-style-type: none"> <li>1. Parasite benefits/gains <u>AND</u> host is harmed/negatively affected.<br/><br/>in terms of nutrients/energy/food (can be applied to either parasite or host).</li> <li>2. Example of a parasitic relationship with parasite and host named <u>AND</u> benefit/harm described.</li> <li>3. Parasites (often) have limited metabolism so cannot live out of contact with host.</li> <li>4. Parasites transmitted/passed on by direct contact/resistant stages/vectors.<br/>(any 2)</li> <li>5. A third example from point 4.</li> <li>6. Some parasites have a secondary host to complete their life cycle or correct description.<br/>(any 4)</li> </ol> | 4        |                     |

| Question |     |      | Expected response  | Max mark | Additional guidance                     |
|----------|-----|------|--|----------|---|
| 12.      | (a) | (i)  | Deletion/insertion   | 1        |   |
|          |     | (ii) | <p>Effect on lactase gene:<br/>All the codons/base sequences nucleotide sequences/ triplets/ bases/nucleotides after the mutation will change/will move along.</p> <p><b>OR</b></p> <p>All the following codons/base sequences nucleotide sequences/triplets will change. (1)</p> <p>Effect on structure of lactase:<br/>All the amino acids after the mutation may change (1)</p> | 2        | <b>NOT</b> - Amino acids produced/made. |
|          | (b) | (i)  | <p>Gene is permanently switched on.</p> <p><b>OR</b></p> <p>More transcription occurred.</p> <p><b>OR</b></p> <p>Repressor molecule not produced so operator permanently switches on gene/gene not switched off.</p>   | 1        |   |
|          |     | (ii) | Founder effect/genetic drift.  | 1        |   |

| Question |     |      | Expected response   | Max mark | Additional guidance                           |
|----------|-----|------|---|----------|---|
| 13.      | (a) | (i)  | Vitamin C (content).  | 1        |   |
|          |     | (ii) | <p>From 2n to 4n (51.7-60)/above 2n it increases. (1)</p> <p>From 4n (to 6n)/above 4n it stays constant/levels out. (1)</p> <p><b>OR</b></p> <p>From 2 sets to 4 sets of chromosomes it increases. (1)</p> <p>Above 4 sets of chromosomes it stays constant/levels out. (1)</p> <p><b>OR</b></p> <p>Increases to 4n then stays constant/levels out. (2)</p> <p><b>OR</b></p> <p>It increases then levels out. (1)</p> | 2        | <b>NOT</b> - Steadies out/ does not increase. |
|          | (b) |      | 20  | 1        |   |
|          | (c) |      | <p>(Complete) non-disjunction.</p> <p><b>OR</b></p> <p>Failure of chromosomes/chromatids to separate (at cell division).</p> <p><b>OR</b></p> <p>Spindle (fibre) failure.</p> <p><b>OR</b></p> <p>Errors during separation of chromosomes.</p>  | 1        |   |

| Question |     | Expected response  | Max mark | Additional guidance |
|----------|-----|--|----------|---------------------|
| 13.      | (d) | <p>Mutation can occur in extra chromosome/gene/DNA while original protein still produced/genes still function.</p> <p><b>OR</b></p> <p>Provides new/extra genetic material on which natural selection can work.</p> <p><b>OR</b></p> <p>Polyploid can no longer breed with the original population.</p> <p><b>OR</b></p> <p>Polyploidy can make (sterile) hybrids fertile.</p> | 1        |                     |

| Question |   |     | Expected response   | Max mark | Additional guidance |
|----------|---|-----|---|----------|---------------------|
| 14.      | A | (i) | <ol style="list-style-type: none"> <li>1. Prokaryotes have circular <u>chromosomes</u> and plasmids.</li> <li>2. Yeast has plasmids.</li> <li>3. Circular <u>chromosomes</u> in mitochondria/chloroplasts.</li> <li>4. Linear <u>chromosomes</u> in nucleus of eukaryotes.</li> <li>5. Prokaryotes have circular DNA <b>AND</b> eukaryotes have linear DNA (Only if point 1 or 4 not awarded).</li> <li>6. Linear/eukaryotic/nuclear chromosome/DNA (tightly) coiled.</li> <li>7. Linear/eukaryotic/nuclear chromosome/DNA packaged with/wrapped around (associated) proteins/histones.</li> </ol> <p style="text-align: right;"><b>(any 4)</b></p> | 9        |                     |

| Question |   |      | Expected response  | Max mark | Additional guidance                                 |
|----------|---|------|--|----------|---|
| 14.      | A | (ii) | <p>a. Amplification/produces multiple copies of (target sequence of) DNA.</p> <p>b. (Heated to) 90°C - 98°C to separate strands/denature DNA/break hydrogen bonds.</p> <p>c. (Cooled to) 50°C - 65°C for primers to bind/anneal.</p> <p>d. Primers are complementary to/bind to target sequences/DNA.</p> <p>e. (Heated to) 70°C - 80°C so DNA polymerase replicates DNA/extends new DNA strand/adds nucleotides to new strand/3' end/primer.</p> <p>f. Heat tolerant DNA/Taq polymerase is used.</p> <p>g. Repeated cycles (of heating and cooling).</p> <p>Used in forensic/paternity etc.<br/>(any 5)</p> |          | NOT - Copy/multiplies/replication of/ magnifies DNA |

| Question |   |     | Expected response  | Max mark | Additional guidance  |
|----------|---|-----|--|----------|--|
| 14.      | B | (i) | <ol style="list-style-type: none"> <li>1. Single strand of nucleotides.</li> <li>2. (nucleotide) contains ribose sugar, phosphate and base.</li> <li>3. Adenine, cytosine, guanine and uracil.</li> <li>4. mRNA takes copy of DNA code from nucleus to ribosome.</li> <li>5. 3 bases on mRNA codes for an amino acid/is a codon.</li> <li>6. tRNA picks up specific/one type of amino acid.</li> <li>7. tRNA carries amino acid to a ribosome.</li> <li>8. tRNA has anticodon (complementary to codon) AND an amino acid attachment site.</li> <li>9. rRNA (combined) with protein forms a ribosome.</li> <li>10. If points 4 -9 not awarded, award point for stating mRNA, tRNA and rRNA.</li> </ol> <p style="text-align: right;"><b>(any 6)</b></p> | 9        | <p><b>NOT</b> - Letter of bases alone.</p> <p><b>NOT</b> - "DNA has thymine and RNA has uracil" alone.</p> |

| Question |      | Expected response   | Max mark | Additional guidance |
|----------|------|---|----------|---------------------|
|          | (ii) | <p>a. Introns removed from primary transcript.</p> <p>b. Exons joined/spliced together to produce mature transcript.</p> <p>c. Exons coding/expressed AND introns non coding/not expressed.</p> <p>d. Alternative (RNA)splicing produces different mature transcripts.</p> <p>e. (Different mature transcripts produced) depending on which (combinations of) exons are retained/spliced together/ removed.</p> <p style="text-align: right;">(any 3)</p> |          |                     |

[END OF MARKING INSTRUCTIONS]