



National  
Qualifications  
2019

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**2019 Biology**

**Higher - Paper 1 - Multiple Choice**

**Finalised Marking Instructions**

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**Marking instructions for each question**

<b>Question</b>	<b>Response</b>	<b>Mark</b>
1.	D	1
2.	C	1
3.	A	1
4.	D	1
5.	B	1
6.	C	1
7.	A	1
8.	B	1
9.	A	1
10.	B	1
11.	C	1
12.	C	1
13.	A	1
14.	B	1
15.	B	1
16.	A	1
17.	D	1
18.	B	1
19.	D	1
20.	D	1
21.	B	1
22.	C	1
23.	A	1
24.	C	1
25.	D	1

**[END OF MARKING INSTRUCTIONS]**



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**2019 Biology**  
**Higher - Paper 2**  
**Finalised Marking Instructions**

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## General marking principles for Higher Biology

Always apply these general principles. Use them in conjunction with the detailed marking instructions, which identify the key features required in candidates' responses.

- (a) Always use positive marking. This means candidates accumulate marks for the demonstration of relevant skills, knowledge and understanding; marks are not deducted for errors or omissions.
- (b) If a 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 must seek guidance from your team leader.
- (c) Do not award half marks.
- (d) Where a candidate makes an error in the first part of a question, award marks for subsequent answers that are correct with regard to this original error. Do not penalise candidates more than once for the same error.
- (e) Unless a numerical question specifically requires evidence of working to be shown, award full marks for a correct final answer (including units, if appropriate) on its own.
- (f) Candidates should not use bulleted lists to answer extended-response questions. They must respond to the 'command' word as appropriate and provide extended answers 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.
- (g) In the detailed marking instructions, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.
- (h) In the detailed marking instructions, words separated by / are **alternatives**.
- (i) A correct response can be negated if the candidate includes:
  - an extra, incorrect, response
  - additional information that contradicts the correct response
- (j) Where the candidate is instructed to choose one question to answer but instead answers two questions, mark both responses and award the higher mark.
- (k) Unless otherwise required by the question, the use of abbreviations (for example DNA, ATP) or chemical formulae (for example CO<sub>2</sub>, H<sub>2</sub>O) are acceptable alternatives to naming.
- (l) 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, do not penalise candidates repeatedly.
- (m) If incorrect spelling is given, sound out the words.
  - If the correct word is recognisable then award the mark.
  - If the word can easily be confused with another biological term then **do not** award the mark, for example glucagon and glycogen.

**(n) Presentation of data:**

- If a candidate provides two graphs, in response to one question, mark both and award the higher mark.
- If a question asks for a particular type of graph/chart and the candidate gives the wrong type, do not award full marks. 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 award the scale and label mark.
- If the graph uses less than 50% of the axes then do not award the scale and label mark.
- If 0 is plotted when no data for this is given, then do not award the plot mark – candidates should only plot the data given.

**(o) Only award marks for a valid response to the question asked. For example, in response to questions that ask candidates 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

Question		Expected response	Max mark	Additional guidance
1.	(a)	Histone	1	Not - Protein alone. Not - Associated proteins.
	(b)	So DNA polymerase can add nucleotides to the 3' end of the new strand  OR To give DNA polymerase a start point for replication	1	Not - To start/initiate replication alone.
	(c)	(i) DNA <u>polymerase</u> adds nucleotides to the 3' end of the primer/new strand  OR DNA <u>polymerase</u> replicates in a 5' to 3' direction.	1	
		(ii) (DNA) ligase	1	
	(d)	Circular chromosomes (1)  Plasmids (1)  If neither answer above is given then award a maximum 1 mark only for:  Circular (DNA)	2	

Question		Expected response	Max mark	Additional guidance
2.	(a)	3:5:30	1	
	(b)	Protein	1	Not - Amino acids
	(c)	<p>Change in the sequence may change the structure/function/shape of the ribosome</p> <p><b>OR</b></p> <p>Ribosome is not made/formed/usable (1)</p> <p>Translation can no longer occur</p> <p><b>OR</b></p> <p>mRNA cannot join to ribosome</p> <p><b>OR</b></p> <p>tRNA cannot join to mRNA (1)</p>	2	
	(d)	<p>DNA double strand, (r)RNA single strand</p> <p><b>OR</b></p> <p>DNA has thymine, (r)RNA has uracil</p> <p><b>OR</b></p> <p>DNA has deoxyribose sugar, (r)RNA has ribose</p>	1	Not - T and U.

Question		Expected response	Max mark	Additional guidance
3.	A	<ol style="list-style-type: none"> <li>1. On inner membrane/cristae of mitochondrion</li> <li>2. NAD/NADH passes/carries electrons and hydrogen ions to inner mitochondrial membrane or electron transport chain.</li> <li>3. Electrons are passed along the electron transport chain/ proteins/series of carriers</li> <li>4. Energy pumps/passes hydrogen ions across the inner mitochondrial membrane</li> <li>5. hydrogen ions flow back through ATP synthase</li> <li>6. ATP synthase produces ATP</li> </ol> <p style="text-align: right;">(any 4)</p>	4	
	B	<ol style="list-style-type: none"> <li>1. Inhibitor binds to the active site</li> <li>2. Prevents substrate binding/ joining</li> <li>3. Competitive inhibition can be reversed/overcome by increased substrate concentration</li> <li>4. Feedback inhibition occurs when end product is at a critical/high concentration</li> <li>5. The end product inhibits/binds to the first enzyme or an earlier enzyme</li> <li>6. This blocks the pathway</li> </ol> <p><b>OR</b></p> <p>Prevents synthesis of end product</p> <p style="text-align: right;">(any 4)</p>	4	



Question			Expected response	Max mark	Additional guidance
4.	(a)	(i)	Hydrogen	1	
		(ii)	Introns/non-coding sequences are removed from the primary transcript <b>OR</b> Gene/primary transcript has introns and exons, mature transcript has (only) exons. <b>OR</b> RNA splicing	1	
	(b)	(i)	Section of a chromosome/gene(s) is added to its homologous partner <b>OR</b> A gene moves from a chromosome to its homologous partner	1	
		(ii)	Beneficial mutations can occur in one of the copies of the gene/DNA (1)  The other gene can still be expressed to produce its protein (1)	2	Must be clear mutation is occurring in one copy of the gene

Question		Expected response	Max mark	Additional guidance
5.	(a)	Geographical (1)	2	Not - Prevents gene flow/exchange between species Not - Prevents gene flow alone
		Prevents gene flow between populations/groups OR Prevents populations/groups interbreeding (1)		
	(b)	(i) 5	1	
		(ii) Behavioural isolation/barrier OR Ecological isolation/barrier OR Sympatric speciation	1	
	(c)	DNA sequence data OR Fossils/fossil records OR Mutation rate	1	

Question		Expected response	Max mark	Additional guidance
6.	(a)	<p>To show the effect of the mutations</p> <p><b>OR</b></p> <p>To show the effect of the drugs/ each drug</p> <p><b>OR</b></p> <p>To prove the drugs affect/increase chloride transport</p> <p><b>OR</b></p> <p>To compare with and without drugs</p>	1	Not - To compare alone
	(b)	<p>Treatment - P (1)</p> <p>Mutation - B (1)</p>	2	
	(c)	<p>An average was calculated</p> <p><b>OR</b></p> <p>Results are averaged</p>	1	
	(d)	<p>Personalised medicine</p> <p><b>OR</b></p> <p>Pharmacogenetics</p>	1	

Question			Expected response	Max mark	Additional guidance
7.	(a)	(i)	Prokaryotes have a smaller genome <b>OR</b> Eukaryotes have a larger genome	1	If figures quoted they must be correct to award the mark.
		(ii)	800	1	
		(iii)	4100	1	
	(b)		$2.52/2.5 \times 10^7$ <b>OR</b> 25 200 000	1	
	(c)		Regulates transcription <b>OR</b> Transcribed to tRNA/rRNA	1	Not - Transcribed but not translated alone
	(d)		There are different combinations of exons in the mature transcript <b>OR</b> Different exons are removed from the primary transcript	1	Not - any reference to a change in sequence of exons: eg different order of exons  Not - Depends on which exons are treated as introns

Question		Expected response	Max mark	Additional guidance
8.	(a)	From 0 to 60 minutes lactose concentration stays at 0.6 mM (1)	2	Award 1 mark for correct description and values with no units.
		From 60 to 180 minutes lactose concentration falls to 0mM (1) (unit must be given at least once)		
	(b)	(i) Any value above 60 up to and including 80	1	
		(ii) Saves/conserves energy/amino acids  OR  Energy/amino acids are not wasted  OR  Prevents build-up of beta-galactosidase	1	Not - Makes glucose for respiration Not - Saves food
	(c)	Reduces activation energy	1	

Question		Expected response	Max mark	Additional guidance
9.	(a)	Cytoplasm	1	
	(b)	(i) Phosphorylates/glucose/ intermediate(s) <b>OR</b> Adds phosphate to glucose/ intermediates <b>OR</b> Gives energy to glucose/ intermediates	1	Not - Gives energy alone
		(ii) More (ATP) is made than is used <b>OR</b> 2 ATPs are used but 4 ATPs are made	1	
		(iii) Removes hydrogen/ions and electrons (1)  Passes them to (coenzyme) NAD <b>OR</b> Turns NAD to NADH (1)	2	Not - Passes hydrogen ions and electrons to electron transport chain
	(c)	(i) Absence of oxygen	1	
		(ii) Produces NAD to pick up more hydrogen ions and electrons <b>OR</b> Produces NAD which is needed for glycolysis	1	

Question		Expected response	Max mark	Additional guidance	
10.	(a)	Citric acid will be turned into isocitrate	1		
	(b)	Enzymes would work more slowly <b>OR</b> Enzyme activity would be lower	1	Not - Enzymes work fastest at optimum temperature	
	(c)	(i)	3·4	1	
		(ii)	(Citric) acid was produced <b>OR</b> No buffer is added	1	
		(iii)	Concentration of Oxygen sugars substrate <b>OR</b> Sterility	1	
		(iv)	To kill any (other) microorganisms/ bacteria/fungi <b>OR</b> To ensure (other) microorganisms/ bacteria/fungi were not present <b>(1)</b>  Which would compete with <i>A.niger</i> <b>OR</b> Which would spoil/contaminate end product/citric acid <b>(1)</b>	2	Not - organisms

Question		Expected response	Max mark	Additional guidance
11.	(a)	Saves/conserves energy OR Less energy used/wasted	1	Not - Regain/gain energy  Not - Survives adverse conditions alone
	(b)	Heart/breathing rate OR Body temperature OR Oxygen consumption/uptake OR Carbon dioxide/heat production	1	
	(c)	720	1	
	(d)	6 (hamsters) in each group OR Several (hamsters) in each group	1	Not - Same number of hamsters in each group alone Not - 4 groups of 6 hamsters
	(e)	Temperature OR Body mass/age/species OR Photoperiod	1	
	(f)	Migration	1	



Question			Expected response	Max mark	Additional guidance
12.	(a)	(i)	Time of exposure to UV light <b>OR</b> Type of yeast	1	
		(ii)	To ensure cells/yeast were only exposed to UV light <b>OR</b> So no other light affects cells/yeast <b>OR</b> To control how much UV light cells/yeast were exposed to	1	Not - So no other light affects results/experiment
	(b)		Axes correctly labelled and scale correct (1) Points correctly plotted and joined (1) Lines labelled or key (1)	3	Lines must go through all points
	(c)		As the time of exposure increased, survival of the M/WT/yeast/cells decreased <b>OR</b> WT (yeast) can survive a longer exposure time to UV light than M yeast <b>OR</b> WT yeast has higher/better survival when exposed to UV light (or converse)	1	Not - As the time of exposure to UV light increased, numbers of yeast colonies decreased
	(d)		Put a layer of sunscreen/ lotion over the plates of (M) yeast/cell(s) (1)  Compare with plates/cells/yeast with no sunscreen (1)	2	

Question		Expected response	Max mark	Additional guidance	
13.	(a)	Biomagnification/Bioaccumulation <b>OR</b> Toxic to/kills  non-target/other species/other animals <b>OR</b> Persistent (in the environment) <b>OR</b> Results in resistant population of pests	1		
	(b)	(i)	Wheel bugs eat/prey on/kill/reduce numbers of stink bugs  <b>so</b> there are fewer (of the stink bugs) to kill (with insecticides)	1	
		(ii)	Integrated pest management	1	Not - IPM
	(c)	(i)	Spread rapidly (1)  Eliminate native/UK species (1)	2	Not - increase rapidly  Not - Prey on/hybridise/compete with native species alone
		(ii)	Free from predators/competitors/pathogens/parasites  that were found in their native/original/habitat	1	

Question			Expected response	Max mark	Additional guidance
14.	(a)	(i)	Transmit/transfer  bacteria/parasite/pathogen/ <i>B.burgdorferi</i>  to  humans/host/animals	1	
		(ii)	Take blood/food/energy/nutrients from humans who are harmed by this	1	Do not award the mark if there is any reference to the harm being caused by disease/bacteria.
	(b)	(i)	335	1	
		(ii)	Temperature/Table 1 is global and Lyme disease/Table 2 is UK <b>OR</b> Temperature/Table 1 and Lyme disease/Table 2 are over different times/years <b>OR</b> Another variable/factor such as increase in number of ticks may be the cause	1	Do not award the mark if the terms reliable/accurate are used incorrectly.  Accept description of this using examples from both tables  If figures quoted they must be correct
	(c)		Method 1:  Fewer/no ticks/vectors to carry/spread bacteria/ <i>B.burgdorferi</i> <b>OR</b> Ticks/vectors are killed so cannot carry/spread bacteria/ <i>B.burgdorferi</i> <b>(1)</b>  Method 2:  Fewer/no bacteria/ <i>B.burgdorferi</i> in animals so no/fewer infected ticks to transmit it to humans. <b>OR</b> Fewer/no/Less bacteria/infected animals so less chance of disease being passed on to humans <b>OR</b> When tick bites the animal_it will not pick up the bacteria/ <i>B.burgdorferi</i> and so cannot transmit it to humans <b>(1)</b>	2	

Question			Expected response	Max mark	Additional guidance
15.	(a)	(i)	93	1	
		(ii)	<p>Monkeys live in treetops so are more likely to see/be seen by a bird of prey</p> <p><b>OR</b></p> <p>Monkeys live in tree tops so are less likely to see/be seen by a human/snake</p>	1	
	(b)		<p>They draw predators' attention to themselves</p> <p><b>OR</b></p> <p>They risk their life/put themselves in danger (1)</p> <p>This warns/benefits/protects others/group</p> <p><b>OR</b></p> <p>This allows/helps others to escape (1)</p>	2	Not - Donor harmed while recipient benefits alone
	(c)		<p>Young monkeys have not learnt/are still learning alarm calls</p> <p><b>OR</b></p> <p>Adults have learned alarm calls</p>	1	
	(d)		<p>Forming alliances: Increases/improves/maintains position in social hierarchy (1)</p> <p>Appeasement: Reduce/avoid conflict/tension/violence/aggression/fighting (1)</p>	2	Not - Stops/prevents/removes conflict/tension/violence/aggression/fighting

Question			Expected response	Max mark	Additional guidance
16.	A	(i)	<ol style="list-style-type: none"> <li>1. Energy absorbed by carotenoids is passed to chlorophyll (1)</li> <li>2. Electrons in the pigment molecules become excited (1)</li> <li>3. Electrons pass along electron transport chain releasing energy (1)</li> <li>4. This energy is used by ATP synthase to produce ATP (1)</li> <li>5. Energy is also used for photolysis (to split water) (1)</li> </ol> <p style="text-align: center;"><b>Max 3 marks from points 1-5</b></p>	3	Do not award point 5 stated that ATP/energy from ATP is used to split water.
	A	(ii)	<ol style="list-style-type: none"> <li>a. ATP and hydrogen/NADPH from the first stage are used in carbon fixation/Calvin cycle (1)</li> <li>b. Carbon dioxide is joined to RuBP to form 3PG (1)</li> <li>c. By RuBisCO (1)</li> <li>d. 3PG is phosphorylated by ATP to form G3P (1)</li> <li>e. Hydrogen/NADPH is required for this step (1)</li> <li>f. G3P is used to make glucose (1)</li> <li>g. G3P is used to make/regenerate RuBP (1)</li> </ol> <p style="text-align: center;"><b>Max 4 marks from points a-g</b></p>	4	<p>Accept full names.            RuBP - ribulose bisphosphate            3PG - 3 - phosphoglycerate            G3P - glyceraldehyde - 3 - phosphate</p> <p>Diagrams must be correctly labelled and arrows must show direction of reactions</p>

Question			Expected response	Max mark	Additional guidance
16.	B	(i)	<p>1. With the bottleneck effect there is low/reduced genetic diversity (1)</p> <p>2. Bottleneck effect occurs in small/reduced populations (1)</p> <p>3. Less able to evolve/to adapt to environmental change (1)</p> <p>4. Inbreeding occurs resulting in poor reproductive rates (1)</p> <p style="text-align: center;"><b>Max 2 marks from points 1-4</b></p>	2	
	B	(ii)	<p>a. Habitats become separated/split/isolated (1)</p> <p>b. Suitable example of how fragmentation occurs e.g. building roads, forest fire, deforestation, clearing of habitats (1)</p> <p>c. Degradation/erosion of fragments/edges increases competition between species (1)</p> <p>d. Habitat fragments have low/lower biodiversity/genetic diversity/species diversity (1)</p> <p>e. Smaller/more isolated fragments have lower biodiversity/genetic diversity/species diversity (1)</p> <p>f. Habitat corridors link fragments</p> <p><b>OR</b></p> <p>Habitat corridors allow movement between fragments (1)</p> <p>g. Increased access to mates/food (1)</p> <p>h. Recolonisation of fragments after extinction (1)</p> <p style="text-align: center;"><b>Maximum 5 Marks from points a-h</b></p>	5	Not - Habitats become fragmented

**[END OF MARKING INSTRUCTIONS]**