



National  
Qualifications  
2025

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## 2025 Biology

### Higher - Paper 2

# Question Paper Finalised Marking Instructions

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## General marking principles for Higher Biology

*Always apply these general principles. Use them in conjunction with the 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:
  - 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, justify**, 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)	Deoxyribose (sugar)	1		
	(b)	(i)	Any value or any range from 70 to 80 inclusive.	1	
		(ii)	Adds nucleotides to the primer/new strand.  <b>OR</b>  Replicates DNA/ target sequence.	1	
	(c)	(i)	DNA is replicated continuously.  <b>OR</b>  Nucleotides are added continuously.  <b>OR</b>  There are no fragments (to join).  <b>OR</b>  There is no lagging strand.	1	
		(ii)	It is not heat tolerant/resistant.  <b>OR</b>  It would be denatured.	1	
	(d)		1.6	1	
	(e)		17 920	1	

Question			Expected response	Max mark	Additional guidance
2.	(a)	(i)	Deletion	1	
		(ii)	All the amino acids after the mutation are changed/ affected.  <b>OR</b> All the codons after the mutation are changed/affected which changes/affects the amino acids.	1	
	(b)		No/ineffective myostatin so no/ less inhibition of growth of muscle.	1	Must be clear that increased muscle growth is due to less inhibition by myostatin.
	(c)		Beef cattle have a longer length of pregnancy than dairy cattle.  <b>OR</b> Dairy cattle have a shorter length of pregnancy than beef cattle. (1)  Beef cattle have a lower birth mass than dairy cattle.  <b>OR</b> Dairy cattle have a higher birth mass than beef cattle. (1)	2	
3.	(a)	(i)	Behavioural/reproductive	1	
		(ii)	Prevents gene flow/interbreeding.  <b>OR</b> Prevents breeding between populations/groups.	1	
	(b)	(i)	Any value between 12000 and 14000 inclusive.	1	
		(ii)	The same fish may have been counted more than once.  <b>OR</b> Not every fish passes the video cameras.	1	
		(iii)	Blue fish decrease and red fish increase.	1	

Question		Expected response	Max mark	Additional guidance
	(c)	<p>They would not be able to interbreed/breed together to produce fertile offspring.</p> <p><b>OR</b></p> <p>Many/significant differences in base sequences.</p>	1	

Question			Expected response	Max mark	Additional guidance
4.	(a)	(i)	Sequence data	1	
		(ii)	380	1	
		(iii)	2	1	
		(iv)	Last common ancestor of monocots and gymnosperms was more recent than monocots and lycopodiophyta.  <b>OR</b>  Monocots diverged more recently from gymnosperms than from lycopodiophyta.	1	
	(b)	(i)	Entire hereditary information encoded in DNA.	1	
		(ii)	Alternative (RNA) splicing occurs.  <b>OR</b>  Different combinations of exons are retained. (1)  Different/multiple mature transcripts are produced. (1)	2	

Question		Expected response	Max mark	Additional guidance
5.	A	<ol style="list-style-type: none"> <li>1. transcription occurs in the nucleus</li> <li>2. RNA polymerase unwinds the DNA/double helix</li> <li>3. Hydrogen bonds break between the bases/strands</li> <li>4. Complementary base pairing occurs</li> <li>5. A primary transcript is formed</li> </ol> <p><b>OR</b></p> <p>The primary transcript contains introns and exons</p> <ol style="list-style-type: none"> <li>6. Introns are removed/exons joined/retained in (RNA) splicing</li> <li>7. (Splicing)forms the mature transcript</li> </ol> <p style="text-align: right;"><b>Any 4</b></p>	4	Award marks for correctly labelled diagrams.
	B	<ol style="list-style-type: none"> <li>1. Duplication adds gene(s)/section of chromosome from/to its homologous partner/chromosome</li> <li>2. Deletion removes gene(s)/section of chromosome</li> <li>3. Inversion is where a gene(s)/section of chromosome is reversed/flipped/rotated 180°</li> <li>4. Translocation adds gene(s)/section of chromosome from a non-homologous/different chromosome</li> <li>5. Duplication is important in evolution</li> </ol> <p><b>OR</b></p> <p>Duplication allows beneficial mutations to occur in duplicated gene while original gene is still expressed</p> <ol style="list-style-type: none"> <li>6. chromosome mutations can be lethal</li> <li>7. Naming all 4 mutations - <b>Only award if none of points 1-4 are awarded.</b></li> </ol> <p style="text-align: right;"><b>Any 4</b></p>	4	

Question			Expected response	Max mark	Additional guidance
6.	(a)	(i)	Catabolic	1	
		(ii)	<p><b>Description:</b> Active site changes shape. (1)</p> <p><b>Explanation:</b> Lowers the activation energy.</p> <p><b>OR</b></p> <p>Lowers the energy required for the reaction. (1)</p>	2	
	(b)		<p><b>Description:</b> Binds to/inhibits enzyme 1/earlier enzyme. (1)</p> <p><b>Advantage:</b> Saves energy/resources.</p> <p><b>OR</b></p> <p>Prevents over-production/build-up of end product/isoleucine. (1)</p>	2	
	(c)	(i)	<p>All active sites are occupied.</p> <p><b>OR</b></p> <p>No more active sites available.</p>	1	
		(ii)	<p>Inhibition is not reversed/reduced/overcome by increasing/high substrate concentration.</p> <p><b>OR</b></p> <p>Increasing substrate concentration does not affect the rate of reaction at high substrate concentrations.</p> <p><b>OR</b></p> <p>Same maximum rate of reaction is not reached by increasing substrate concentration.</p>	1	

Question			Expected response	Max mark	Additional guidance
7.	(a)	(i)	Inner mitochondrial membrane	1	
		(ii)	ATP synthase	1	
		(iii)	Y oxygen/O <sub>2</sub> (1) Z water/H <sub>2</sub> O (1)	2	
	(b)		Carries/transfers/hydrogen ions and electrons. (1)  From glycolysis/citric acid cycle/cytoplasm/matrix of mitochondria.  <b>OR</b>  To electron transport chain/inner mitochondrial membrane. (1)	2	
	(c)		Fewer electrons move along the electron transport chain/carrier proteins releasing energy.  <b>OR</b>  Less energy to move hydrogen ions across the membrane.  <b>OR</b>  Less hydrogen ions pumped/actively transported across the membrane. (1)  Less hydrogen ions to pass through/drive/rotate ATP synthase. (1)	2	
8.	(a)	(i)	From 2.0 to 2.4 m/s it stays constant at 1.4 mmol/L. (1)  From 2.4 m/s it increases to 6.3 mmol/L. (1)	2	Award 1 mark for remains constant to 2.4m/s then increases.
		(ii)	1.7	1	
		(iii)	47.5/47.54/47.541	1	
	(b)	(i)	0.8	1	
		(ii)	4.4	1	
	(c)		Fermentation	1	
	(d)		Lactate is converted to pyruvate.	1	

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	10 : 3 : 8	1	
		(ii)	Plants grown in soil with arsenic + ARB have lower pigment/chlorophyll/ carotenoid levels than plants grown in soil with no arsenic.	1	
		(iii)	<p>Increase/extend the range/number of wavelengths/ colours of light absorbed.</p> <p><b>OR</b></p> <p>Broadens absorption spectrum.</p> <p><b>OR</b></p> <p>Absorbs wavelengths/light/colours of light not absorbed by chlorophyll. (1)</p> <p>Energy passed on to chlorophyl. (1)</p>	2	
	(b)		<p>To excite electrons (in pigment molecule). (1)</p> <p>Transfer of the electrons along/through the electron transport chain releases energy. (1)</p> <p>ATP is generated by ATP synthase. (1)</p> <p><b>Any 2 from 3</b></p>	2	

Question			Expected response	Max mark	Additional guidance
10.	(a)	(i)	They compete for light/space/minerals/water/ nutrients.	1	
		(ii)	Weeds have broader leaves so absorb more chemical.	1	
	(b)	(i)	60	1	
		(ii)	More people/population increasing. (1)  More resistant weeds so less crops/yield.  <b>OR</b>  More resistant weed/species so more competition with crops/wheat. (1)	2	
	(c)		Resistant (weeds) survive or non-resistant (weeds) die. (1)  pass on resistance alleles/genes to offspring/next generation. (1)	2	

Question			Expected response	Max mark	Additional guidance
11.	(a)	(i)	Sumithion concentration	1	
		(ii)	Temperature of water/solution. <b>OR</b> pH/salinity of water/solution. <b>OR</b> Species/type of eggs/fish.	1	
		(iii)	0.0/0 (1)  Shows that sumithion was reducing hatching success. <b>OR</b> Shows the effect of sumithion (on hatching success). <b>OR</b> To compare with sumithion. (1)	2	
	(b)		Axes correctly labelled and scale correct. (1)  Points correctly plotted and joined. (1)	2	
	(c)		As sumithion concentration increased hatching success decreased (until 0.8 mg/L) then remained the same.	1	
	(d)		Bioaccumulation/biomagnification. <b>OR</b> Persistence in the environment. <b>OR</b> Results in resistant pest (populations).	1	

Question			Expected response	Max mark	Additional guidance
12.	(a)	(i)	210	1	
		(ii)	There are range bars	1	
		(b)	F <sub>2</sub> show variation	1	
	(c)	(i)	Cost effective.  OR  Cheap.  OR  Less land/labour.  OR  High profits.  OR  High productivity.	1	
		(ii)	There is increased/high chance of transmission by direct contact.  OR  Overcrowding so parasites are spread by direct contact.	1	
		(iii)	Hysteria	1	
13.	(a)		Fly offspring benefit/gain while the bee larvae are harmed/lose. (1)  by gain/loss of pollen/nutrients/energy/food. (1)	2	
	(b)		Worker (bees) defend the hive/larvae.	1	
	(c)		Ensures shared genes survive/will be passed on.  OR  Increases survival of shared genes.	1	

Question			Expected response	Max mark	Additional guidance
14.	(a)	(i)	Co-operative hunting	1	
		(ii)	Can catch/kill larger prey.  <b>OR</b>  Less energy used per individual.	1	NOT hunt larger prey.
	(b)		7.1	1	
	(c)		<b>Method:</b> Habitat corridors. (1)  <b>Explanation:</b> Increased access to food/mates.  <b>OR</b>  Recolonisation (after local extinction). (1)	2	

Question		Expected response	Max mark	Additional guidance
15.	A	<ol style="list-style-type: none"> <li>1. animals survive adverse conditions by using dormancy</li> <li>2. dormancy/hibernation/aestivation/daily torpor reduces metabolic rate</li> <li>3. dormancy/hibernation/aestivation/daily torpor reduces heart rate/breathing rate/body temperature</li> <li>4. dormancy/hibernation/aestivation/daily torpor saves energy</li> <li>5. dormancy/hibernation/aestivation/daily torpor allows survival when costs of normal metabolic activity would be too high</li> <li>6. predictive dormancy before (onset of) adverse conditions</li> <li>7. consequential dormancy after onset of adverse conditions</li> <li>8. hibernation in winter/low temperature AND aestivation in high temperature/drought</li> <li>9. daily torpor in animals with high metabolic rates</li> </ol> <p style="text-align: right;">Any 7</p>	7	NOT avoid adverse conditions using dormancy.

Question		Expected response	Max mark	Additional guidance
	B	<p>1. all 4 phases named: lag, log/exponential, stationary and death</p> <p>2. lag phase when enzymes are induced</p> <p><b>OR</b></p> <p>lag phase when DNA replicates</p> <p>3. log/exponential phase when fast/most growth occurs</p> <p>4. log/exponential phase when nutrients are plentiful</p> <p>5. stationary phase when nutrients are being depleted/used up</p> <p><b>OR</b></p> <p>toxic metabolites/toxins produced/build up in stationary phase</p> <p>6. secondary metabolites/antibiotics are produced/build up in stationary phase</p> <p>7. antibiotics/secondary metabolites confer ecological advantage</p> <p><b>OR</b></p> <p>antibiotics/secondary metabolites reduce/remove competition from other microorganisms</p> <p>8. death phase occurs due to toxic accumulation of metabolites/nutrients have run out</p> <p>9. viable cell count is only living micro-organisms</p> <p><b>OR</b></p> <p>total cell count is living and dead micro-organisms</p> <p style="text-align: right;"><b>Any 7</b></p>	7	

[END OF MARKING INSTRUCTIONS]