



National
Qualifications
2026

2026 Human Biology

Higher - Paper 2

Question Paper Finalised Marking Instructions

These marking instructions have been prepared by examination teams for use by Qualifications Scotland appointed markers when marking external course assessments.

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General marking principles for Higher Human 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 CO₂, H₂O) 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**, 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)	(i)	Differentiation/specialisation	1	
		(ii)	Can differentiate/specialise into all/any of the (types of) blood cells. OR Can differentiate/specialise into cells within a particular tissue/of the tissue they come from. OR Can only differentiate/specialise into a limited range of cells/cell types.	1	Do not accept: divide/replicate/multiply for differentiate
		(iii)	They express different genes.	1	
	(b)	(i)	(Cancer cells/they) do not respond to regulatory signals.	1	
		(ii)	From (days) 0-12 the white blood cell count decreased from 88 000 cells/microlitre to 4000 cells/microlitre. OR From (days) 0-12 the white blood cell count decreased by 84 000 cells/microlitre. (1) From (days) 12 - 32 the white blood cell count increased from 4000 cells/microlitre to 80 000 cells/microlitre. OR From (days) 12 - 32 the white blood cell count increased by 76 000 cells/microlitre. (1)	2	Answer must indicate cells/microlitre for at least one figure. Award one mark if candidate states that it decreases to (day) 12 and then increases.
		(iii)	90 000	1	

Question			Expected response	Max mark	Additional guidance
2.	(a)	(i)	Direction of replication. OR Direction nucleotides are being added.	1	
		(ii)	DNA polymerase can only add nucleotides to the 3' end of the primer/new strand. OR DNA polymerase can only add nucleotides in the 5' to 3' direction on the new strand. OR DNA polymerase can only replicate in a 3' to 5' direction on the original strand.	1	
		(iii)	(DNA) ligase	1	
	(b)		Unwinds the helix/DNA/strands. OR Breaks the hydrogen bonds (between the bases)/separates the (DNA) strands. (1) Adds RNA nucleotides to synthesise mRNA/a primary transcript. OR Adds RNA nucleotides using complementary base pairing. OR Adds RNA nucleotides that are complementary to the DNA. (1)	2	

Question			Expected response	Max mark	Additional guidance
2.	(c)		1. (tRNA) folds due to complementary base pairing/hydrogen bonding or (tRNA) shape is due to complementary base pairing/hydrogen bonding 2. (tRNA) is single stranded and is composed of nucleotides 3. (Nucleotides) contain ribose (sugar), phosphate and (one of) the bases cytosine, guanine, adenine and uracil 4. (tRNA) has an anticodon/an exposed triplet of bases (at one end) 5. (tRNA) has an attachment site for a specific amino acid (at the other end) or (tRNA) binds to a specific amino acid (at the other end) Any 3	3	

Question			Expected response	Max mark	Additional guidance
3.	(a)		A C U C G U G A G	1	
	(b)	(i)	Substitution	1	
		(ii)	One amino acid is replaced by another. OR Sequence of amino acids is changed.	1	Do not accept: produced/formed/made for replaced
	(c)		Less oxygen so pyruvate is converted to lactate. OR Less oxygen for aerobic respiration/electron transport chain/ATP production. OR Less oxygen so can only carry out glycolysis. OR Less oxygen so lactate metabolism occurs.	1	Accept: ETC for electron transport chain
	(d)		8375	1	

Question			Expected response	Max mark	Additional guidance
4.	(a)		Cytoplasm	1	
	(b)		(Pyruvate dehydrogenase) removes hydrogen ions and electrons from pyruvate and transfers them to NAD.	1	
	(c)		Substance X - Oxaloacetate. (1) Role - Combines with acetyl (to form citrate). (1)	2	Do not accept: acetyl coenzyme A/ coA
	(d)		ATP production - Decreases (1) Lactate production - Increases (1)	2	
	(e)	(i)	To select the best/most effective drugs/dosage/medicine. OR Use genetic information in choice of drug/dosage/medicine. OR Personalised medicine. OR To reduce side/harmful effects.	1	Do not accept: treatment/ prescription
		(ii)	25%	1	

Question			Expected response	Max mark	Additional guidance
5.	(a)	(i)	4:10:13	1	
		(ii)	3.5	1	
	(b)	(i)	They can contract (relatively) quickly. OR Can respire/generate ATP using glycolysis only. OR Storage fuel is glycogen.	1	
		(ii)	Function - (Myoglobin) stores/provides oxygen (to muscle fibres). OR (Myoglobin) is an oxygen-storing protein. (1) Explanation - (Slow twitch muscle fibres) rely on aerobic respiration/need oxygen AND to generate ATP/support electron transport chain/for muscle contraction. (1)	2	Do not accept: carries/transport oxygen
		(iii)	Slow twitch (muscle fibres) have more mitochondria. OR Slow twitch (muscles) have larger blood supply/more blood capillaries.	1	Accept: converse

Question			Expected response	Max mark	Additional guidance
6.	(a)	(i)	LH/luteinising hormone	1	
		(ii)	Body temperature - Increases (1) Cervical mucus consistency - will be thinner. (1)	2	Accept: converse if answer indicates day 3
	(b)	(i)	Phase A - Follicular (1) Phase B - Luteal (1)	2	
		(ii)	LH stimulates the follicle to develop into a corpus luteum. OR The follicle develops into the corpus luteum following ovulation. (1) Corpus luteum/this secretes progesterone. (1)	2	
		(iii)	Progesterone concentration would remain constant/stay the same/would not decrease/remains high.	1	Accept: oestrogen concentration would remain constant/stay the same/would not decrease/remains high

Question			Expected response	Max mark	Additional guidance
7.	(a)		35	1	
	(b)	(i)	The starting lengths are different. OR To allow a valid comparison.	1	Use of accurate/reliable negatives.
		(ii)	Repeat with more blood vessels. OR Repeat with more veins and arteries. OR Repeat and calculate an average.	1	Use of accurate/valid negatives.
	(c)	(i)	Arteries have more elastic fibres (than veins). OR Veins have fewer elastic fibres (than arteries). OR Arteries have higher elasticity/are more elastic (than veins). OR Veins have lower elasticity/are less elastic (than arteries).	1	Do not accept: veins do not have elastic fibres
		(ii)	To accommodate the surge of the blood/increased blood flow (after each contraction). OR To accommodate the increase in blood pressure (after each contraction).	1	
	(d)		They (smooth muscle) can vasoconstrict and vasodilate.	1	Elastic fibres causing vasodilation/constriction negatives.

Question			Expected response	Max mark	Additional guidance														
8.	(a)	(i)	To act as a control. OR To provide a valid comparison. OR To show the alcohol is reducing sperm count/causing the effect.	1	Use of reliable/accurate negates.														
		(ii)	1. concentration/volume/dosage/ type of alcohol 2. type/breed/age/size/mass/ weight/health/(starting) fertility of mice 3. temperature/conditions mice are kept in or activity of mice. 4. type of food/diet of mice. 5. time of day dose is given/semen is collected. Any 2	2	1. accept: volume of water/ solutions. 3. Accept: presence of other mice. If the candidate lists 3 or more variables and at least 1 is correct award 1 mark for the question. If all answers are correct award 2 marks.														
	(b)	(i)	Axes have correct scales and labels. (1) Points correctly plotted and lines drawn. (1) <table><tr><th>Day semen sample taken</th><th>Average sperm count (million/cm³)</th></tr><tr><td></td><th>Group 2</th></tr><tr><td>0</td><td>45.0</td></tr><tr><td>30</td><td>42.2</td></tr><tr><td>60</td><td>40.2</td></tr><tr><td>90</td><td>38.2</td></tr><tr><td>120</td><td>36.2</td></tr></table>	Day semen sample taken	Average sperm count (million/cm ³)		Group 2	0	45.0	30	42.2	60	40.2	90	38.2	120	36.2	2	Scale breaks are not acceptable. If the axes are transposed do not award the scale mark. The line must go through all the points.
Day semen sample taken	Average sperm count (million/cm ³)																		
	Group 2																		
0	45.0																		
30	42.2																		
60	40.2																		
90	38.2																		
120	36.2																		
		(ii)	Regular alcohol consumption reduces the sperm count (of mice).	1															
		(iii)	35.2	1															

Question			Expected response	Max mark	Additional guidance
8.	(c)		Several samples of semen/sperm are collected. OR A sperm donor can be used. OR Semen/sperm is injected directly into the female reproductive tract/uterus.	1	

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	Component of cell membrane. OR Used to produce sex hormones/oestrogen/testosterone/progesterone.	1	
		(ii)	Insulates the axon. OR Increases the speed of impulses.	1	
	(b)	(i)	Molecule B - High density lipoprotein/HDL. (1) Description - transports excess cholesterol to the liver for elimination. (1)	2	
		(ii)	Negative feedback OR The synthesis of new LDL receptors (in cells) is inhibited.	1	
		(iii)	Structure W - endothelium. (1) Other substance - fibrous material/calcium. (1)	2	
	(c)	(i)	Hirudin/it binds to the active site of thrombin/the enzyme. (1) Fibrinogen would not form fibrin. OR Less/no fibrin is produced. (1)	2	
		(ii)	Increase the concentration of fibrinogen/substrate.	1	

Question			Expected response	Max mark	Additional guidance
10.	(a)		0.26	1	
	(b)	(i)	Sino atrial node/SAN/SA node	1	
		(ii)	(The first sound is) the AV/atrioventricular valves closing (at the end of atrial systole/at the start of ventricular systole). (1) (The second sound is) the SL/semi lunar valves closing (at the end of ventricular systole/during diastole). (1)	2	Award 1 mark for the (opening and) closing of the valves. Any additional information about systole/diastole must be acceptable to award 2 marks.
11.	(a)	(i)	Elaboration. OR Additional information is provided.	1	
		(ii)	Elaboration/it is a deeper form of encoding (than rehearsal). OR Elaboration/it provides more contextual cues (than rehearsal).	1	Accept: rehearsal is a shallower form of encoding (than elaboration)
	(b)		(The information would) decay/be discarded/be displaced.	1	
	(c)		Name - Chunking. (1) Suggestion - This reduces the number of units being encoded. OR A description of reduced number of units. OR More items/information can be stored (as items are) in units. (1)	2	Accept: a description of chunking. i.e grouping smaller units of information into larger units e.g. 11 individual units reduced to 3 units (phone number) Do not accept: smaller units

Question			Expected response	Max mark	Additional guidance
13.	(c)		They diffuse across the cleft/synapse and bind to receptors. (1) A minimum number of neurotransmitters must attach (to receptors). OR The threshold must be reached. (1)	2	

Question			Expected response	Max mark	Additional guidance
14.	A		(Lymphocytes) respond to/recognise specific antigens from pathogens. or Lymphocytes have a specific receptor/surface protein for an antigen. - Antigen binding leads to lymphocyte division or A clonal population is formed. or They undergo clonal selection. - B lymphocytes release antibodies. - Antibodies are Y-shaped proteins that have binding sites/receptors for a specific antigen. or Antibodies are Y-shaped proteins that have specific binding sites/receptors for an antigen. - An antigen-antibody complex forms. or Antibodies inactivate the pathogen. (The antigen-antibody complex/this) can then be destroyed by phagocytosis. - T lymphocytes attach onto antigens on infected cells. - They release proteins into the infected cells. - Causing production of self-destructive enzymes. or Cause cell death/apoptosis. - The remains of the infected cell are then destroyed by phagocytosis. - Some of the (cloned) lymphocytes survive as memory cells. - This allows a faster secondary response/antibody production. or They destroy the pathogen before the individual develops the same infection/symptoms.	8	9. Do not accept cause cell death/apoptosis of a pathogen.

Question			Expected response	Max mark	Additional guidance
14.	B		1. Central nervous system/CNS consists of the brain and spinal cord. 2. The peripheral nervous system/PNS consists of the somatic nervous system/SNS and the autonomic nervous system/ANS. 3. The somatic nervous system contains sensory and motor neurons. 4. Sensory neurons take impulses from sense organs/receptors to the CNS. 5. Motor neurons take impulses from the CNS to muscles/glands/ effectors. 6. The sympathetic and parasympathetic nervous systems are antagonistic. 7. The sympathetic system speeds up heart rate/breathing rate and The sympathetic system slows down/decreases peristalsis/ (production of) intestinal secretions. 8. A sympathetic nerve/system releases noradrenaline. 9. The parasympathetic system slows down heart rate/breathing rate and The parasympathetic system speeds up/increases peristalsis/ (production of) intestinal secretions. 10. A parasympathetic nerve/system releases acetylcholine. 11. The medulla regulates (the rate of) the sino-atrial node/SAN through the autonomic nervous system/ANS or The medulla regulates (the rate of) the sino-atrial node/SAN through the sympathetic and parasympathetic nerves/systems.	8	

[END OF MARKING INSTRUCTIONS]