National
Qualifications
2024

2024 Human Biology

Higher – Paper 1

Question Paper Finalised Marking Instructions

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

Marking instructions for each question

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

[END OF MARKING INSTRUCTIONS]

National
Qualifications
2024

2024 Human Biology

Higher – Paper 2

Question Paper Finalised Marking Instructions

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

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 CO_2, H_20) 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)		A T A G C A	**1**	
	(b)	(i)	Any value from 92 - 98	**1**	Accept any range between 92 - 98
		(ii)	1. allows nucleotides to be added. **OR** allows DNA to be amplified/amplification to start. **OR** provides a starting point for amplification. **(1)** 2. adds/joins (complementary) nucleotides (to a DNA strand/primer). **OR** amplifies DNA. **(1)**	**2**	Accept binds to complementary/target/specific sequence/(section of) DNA. Do not accept bases for nucleotides.
	(c)		1. Solving crimes. 2. Identifying people. 3. Diagnose genetic disorders/mutations. **Any 2 from 3**	**2**	
2.	(a)	(i)	100	**1**	
		(ii)	39/39.3/39.29	**1**	
	(b)	(i)	2679	**1**	
		(ii)	To allow a valid comparison between countries. **OR** (As the countries) have different population sizes/numbers.	**1**	Accept a comparison, e.g. England has a greater/larger population than the other countries.

Question			Expected response	Max mark	Additional guidance
3.	(a)	(i)	1. Concentration/volume of hydrogen peroxide. 2. Volume of copper sulfate/ inhibitor. 3. Concentration/mass/weight of yeast (beads)/type of yeast. **OR** Mass/volume of gel (substance). 4. Size/volume/surface area/ mass/weight/number of beads. 5. Temperature of solution/beads/ (contents of) flask. 6. pH of solutions/beads/(contents of) flask. **Any 2**	**2**	Do not accept enzyme/catalase for yeast. For points 5 & 6 accept yeast/gel (substance)/hydrogen peroxide/ copper sulfate/inhibitor.
		(ii)	The immobilised yeast/beads can be used more than once. **OR** The immobilised yeast/beads can be transferred/removed easily.	**1**	
		(iii)	To allow the beads to absorb the copper sulfate/inhibitor. **OR** To allow the copper sulfate/inhibitor to diffuse into the beads. **OR** To allow for the copper sulfate/inhibitor to react with the catalase.	**1**	

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>3.</td><td>(b)</td><td></td><td>Axes have correct scale and labels. (1)

Points correctly plotted and line drawn. (1)

<table><tr><th>Concentration of copper sulfate (mmol/l)</th><th>Volume of oxygen collected (cm^3)</th></tr><tr><td>0</td><td>82</td></tr><tr><td>5</td><td>68</td></tr><tr><td>10</td><td>45</td></tr><tr><td>25</td><td>25</td></tr><tr><td>50</td><td>16</td></tr></table></td><td>2</td><td>Candidates cannot access the scale mark if the plotted points use less than half the graph paper.

If candidate draws a bar graph they cannot access the scale mark.</td></tr>
<tr><td></td><td>(c)</td><td></td><td>As the inhibitor/copper sulfate concentration increases, the catalase activity decreases.</td><td>1</td><td></td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
4.	(a)	(i)	Y and Z	**1**	
		(ii)	Pyruvate	**1**	
		(iii)	Citrate	**1**	
	(b)		Inner membrane (in mitochondria from muscle cells) has a greater surface area/more folds/is larger/longer. **(1)** For electron transport chains/ATP synthase/hydrogen ions to be pumped across. **(1)**	**2**	
	(c)		They have many mitochondria. **OR** They have a large blood supply. **OR** They have a high concentration of myoglobin. **OR** Their major storage fuel is fat.	**1**	

Question			Expected response	Max mark	Additional guidance
5.	(a)	(i)	(FSH) stimulates development/maturation/growth of the follicle (in the ovary). **(1)** The (developing) follicle releases oestrogen. **(1)**	**2**	
		(ii)	Oestrogen stimulates proliferation/repair/thickening/ regeneration of the endometrium. **OR** Oestrogen prepares the endometrium for implantation.	**1**	
		(iii)	It stimulates ovulation/release of an egg/ovum (from the follicle/ovary).	**1**	
	(b)	(i)	14	**1**	
		(ii)	Corpus luteum	**1**	
	(c)	(i)	Progesterone (concentration) decreases (after day 25/towards the end of the cycle). **OR** Progesterone (concentration) does not remain high (after day 25/towards the end of the cycle).	**1**	
		(ii)	Treatment – IVF. **(1)** Description – eggs are mixed with sperm/fertilised in a culture dish/outside the body. **OR** Description – eggs are (surgically) removed and mixed with sperm/fertilised. **(1)**	**2**	

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>6.</td><td>(a)</td><td></td><td>Could lead to a false positive/negative.
OR
Unnecessary (diagnostic) tests could be carried out.</td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>(Amniocentesis has) a lower risk/chance of miscarriage.
OR
CVS has a higher risk/chance of miscarriage.</td><td>1</td><td>Accept amniocentesis is safer for the fetus.
OR
CVS is more dangerous for the fetus.
OR
Amniocentesis may be carried out later in the pregnancy.
OR
It was too late in the pregnancy for CVS.</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Karyotype</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Autosomes</td><td>1</td><td>Accept autosomal</td></tr>
<tr><td>7.</td><td>(a)</td><td>(i)</td><td>300</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>2 : 48 : 3</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td><table><tr><th>Part of body</th><th>Change in blood flow rate</th><th>Process controlling blood flow</th></tr><tr><td>Intestines</td><td>decrease</td><td>vasoconstriction</td></tr><tr><td>Skeletal muscles</td><td>increase</td><td>vasodilation</td></tr></table>1 mark for part of body.
1 mark for process.</td><td>2</td><td>Accept description of smooth muscle in artery contracting/relaxing for vasoconstriction/vasodilation.</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>150</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>A sympathetic nerve/neuron releases/secretes noradrenaline</td><td>1</td><td></td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
8.	(a)	(i)	Plasma	**1**	
		(ii)	Pressure filtration	**1**	
	(b)		Blood is at a higher pressure (in A). **OR** Vasoconstriction/vasodilation occurs in A but not in D.	**1**	Accept artery/vein for A/D.
	(c)	(i)	Walls are thin/only one cell thick.	**1**	Accept they provide a large surface area (for diffusion). Accept endothelial/endothelium/epithelial/ epithelium for walls.
		(ii)	(Plasma) Protein	**1**	
	(d)	(i)	Absorbs excess tissue fluid. **OR** Carries lymph back to the circulatory system.	**1**	
		(ii)	They prevent the backflow of fluid/lymph. **OR** They make sure that the fluid/lymph only flows in one direction.	**1**	

Question			Expected response	Max mark	Additional guidance
9.	(a)		(An inflatable) cuff stops/restricts blood flow/circulation (in the artery). **OR** (An inflatable) cuff deflates (gradually) so blood flow/circulation (in artery) can resume. **(1)** (Systolic blood) pressure is measured when blood starts to flow/a pulse is detected. **(1)**		
	(b)	(i)	Blood pressure	**1**	
		(ii)	(Consuming) energy drinks increases (diastolic) blood pressure. **OR** (Consuming) energy drinks has no effect on systolic blood pressure.		
		(iii)	97	**1**	
	(c)		Hypertension	**1**	

Question			Expected response	Max mark	Additional guidance
10.	(a)	(i)	Age/gender/ethnicity/other health conditions	**1**	
		(ii)	Type 1 diabetes may cause low vitamin D (concentrations). **OR** Type 1 diabetes may have occurred before/earlier/first. **OR** The results are only from one study/small sample size. **OR** More than half/59% of the control group have low vitamin D concentrations (but not type 1 diabetes).	**1**	
		(iii)	118	**1**	
		(iv)	Repeat the study with larger groups/more individuals in each group. **OR** Repeat the study and calculate an average.	**1**	
	(b)	(i)	From January to May the average hours of sunlight increases/goes from 36 to 184/increases by 148 hours from 36. **(1)** From May to December the average hours of sunlight decreases/goes from 184 to 32 hours/decreases by 152 hours from 184. **(1)**	**2**	Award 1 mark if candidates state it increases to May and then it decreases if no other marks are awarded. Answer must indicate hours for at least one figure.
		(ii)	October to March	**1**	Accept January to March **and** October to December.

Question			Expected response	Max mark	Additional guidance
11.	(a)		Displacement/decay	**1**	
	(b)		Working memory (model)	**1**	
	(c)		STM/it has a limited capacity. **OR** 11 numbers/it exceeds capacity of STM.	**1**	Accept can only hold 5 to 9 numbers/items. Accept can only hold 7 ± 2 numbers/items. Accept any value in the range 5 to 9.
	(d)	(i)	(They could be allocated) by a computer (program)/by selecting names out of a hat.	**1**	Do not accept randomisation only. Accept any other suitable example of random allocation.
		(ii)	(Group 1 used) organisation which allows words to be transferred/ encoded (from STM) to LTM. **OR** Group 2 did not use organisation so fewer words were transferred/ encoded (from STM) to LTM.	**1**	
	(e)		Contextual cues	**1**	

Question			Expected response	Max mark	Additional guidance
12.	(a)		Synapse/synaptic cleft	**1**	
	(b)	(i)	Diverging	**1**	
		(ii)	More than one neuron/muscle/finger is affected/stimulated at the same time. **OR** Impulse/neurotransmitter is sent to many neurons/muscles/fingers giving coordinated movement.	**1**	
	(c)	(i)	Myelin (sheath)	**1**	
		(ii)	It increases the speed of impulses. **OR** It insulates the axon.	**1**	
	(d)	(i)	Fewer receptors/no receptors for the neurotransmitter to bind to. **OR** Fewer receptors/no receptors so impulses/neurotransmitters cannot cause muscle contraction. **OR** The threshold (initiating muscle contraction) cannot be reached.	**1**	Accept neurotransmitters cannot bind to the receptors.
		(ii)	T lymphocytes respond to self-antigens/antigens on own (healthy) cells. **(1)** Attacking/destroying/killing the body's own (healthy) cells. **(1)**	**2**	Accept T lymphocytes fail to recognise self-antigens/antigen on own (healthy) cells. Accept apoptosis of the body's own cells.
		(iii)	10 320	**1**	

Question			Expected response	Max mark	Additional guidance
13.	(a)		1. B lymphocytes have receptors which recognise antigens on pathogen/foreign antigens. 2. (Following recognition) they form clones/a clonal population/copies of themselves. **OR** They undergo clonal selection. 3. B lymphocytes produce antibodies. 4. Antibodies bind to antigens on the pathogen. **OR** The antigen-antibody complex can be destroyed/removed by phagocytosis. **Any 3 from 4**	**3**	
	(b)		Allergy/allergic reaction/ hypersensitive response	**1**	

Question			Expected response	Max mark	Additional guidance
14.	(a)		DNA/RNA/nucleic acid/chromosome	**1**	
	(b)		(Inactivated) pathogen toxins/dead pathogens/weakened pathogens	**1**	
	(c)	(i)	To establish their safety/ effectiveness.	**1**	
		(ii)	Neither the subjects nor the researchers know which group the subjects are in. **OR** Neither the subject nor the researchers know who has been given the placebo/vaccine.	**1**	
	(d)		Antigenic variation occurs. **(1)** Memory cells/memory lymphocytes are not effective against/do not recognise the changed/ mutated/different/new antigen. **OR** Memory cells/memory lymphocytes are not effective against/do not recognise the changed/ mutated/altered pathogen/virus. **(1)**	**2**	

Question			Expected response	Max mark	Additional guidance
15.	**A**		1. A somatic cell is any cell (in the body) other than cells involved in reproduction/germline cells. 2. Germline cells are gametes/ sperm and egg/ova **and** (stem) cells that divide/differentiate to form/produce gametes. 3. Somatic cells divide by mitosis to form (more) somatic cells. 4. Mitosis of germline cells produces (more) germline cells. 5. Meiosis of germline cell produces gametes. 6. Somatic cells/germline stem cells are diploid **and** gametes are haploid. 7. Meiosis has two stages/divisions. 8. First stage/division separates homologous/matching/pairs of chromosomes. 9. Second stage/division separates chromatids. 10. Somatic cells/germline cells divide by mitosis to maintain the (diploid) chromosome number/ complement. 11. Diploid cells have 23 pairs of homologous/matching chromosomes. **OR** Haploid cells/gametes contain 23 single chromosomes/one set of 23 chromosomes. **8 marks from 11**	**8**	3.Accept identical daughter cells for somatic cells. a. Award mark for germline cells can divide by mitosis and meiosis if candidate has **not** been awarded both points 4 and 5.

Question			Expected response	Max mark	Additional guidance
15.	**B**		1. mRNA/primary transcript is transcribed/produced from DNA in the nucleus. 2. RNA polymerase unwinds the DNA **and** breaks the (hydrogen) bonds between the bases/strands. **OR** RNA polymerase unwinds the DNA **and** unzips the strands. 3. RNA polymerase adds complementary RNA nucleotides. **OR** RNA polymerase allows complementary base pairing to occur. 4. RNA contains the (base) uracil instead of thymine. **OR** Uracil in RNA is complementary to/pairs with adenine. 5. The primary mRNA/transcript undergoes (RNA) splicing. 6. Primary mRNA/transcript has introns and exons. 7. Introns are non-coding regions, exons are coding. 8. Introns are removed **and** exons are joined/retained to form mature mRNA/transcript. 9. Different mature mRNA/mature transcripts/proteins can be produced as a result of alternative (RNA) splicing. 10. Different mature mRNA/mature transcripts/proteins can be produced depending on which exons are retained. 11. The order of exons is not changed. **8 marks from 11**	**8**	

[END OF MARKING INSTRUCTIONS]