National
Qualifications
RESOURCE

2021 Human Biology
Section 1

Higher

Finalised Marking Instructions

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Marking instructions for each question

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

[END OF MARKING INSTRUCTIONS]

National
Qualifications
RESOURCE

2021 Human Biology
Section 2

Higher

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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 (eg 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, 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)		Bone marrow	**1**	
	(b)		They only differentiate into blood cells. **OR** They only differentiate into cells of their tissue.	**1**	
	(c)		<u>Therapeutic</u> Corneal repair/regeneration of damaged skin. **(1)** <u>Research</u> (Used as model cells) to study how diseases develop. **OR** (Used as model cells) for drug testing. **OR** Used to study cell processes/cell growth/cell differentiation/gene regulation. **(1)**	**2**	

Question			Expected response	Max mark	Additional guidance
2.	(a)	(i)	Stomach	**1**	
		(ii)	1032	**1**	
		(iii)	20	**1**	
		(iv)	Male deaths from breast cancer may/will be included in (the figures for) other types of cancer.	**1**	
		(v)	More men (compared to women) have stopped smoking (since 2007).	**1**	
	(b)		More cases will be detected/treated earlier. **OR** Treatment is more likely to be effective when detected sooner/at an early stage.	**1**	
	(c)		Cells within the tumour fail to attach to each other (and spread throughout the body).	**1**	

Question			Expected response	Max mark	Additional guidance
3.	(a)	(i)	(Primers) bind/attach to DNA/ strands/3′ end (of the DNA) **OR** (Primers) bind/attach to a complementary section/target sequence/complimentary nucleotides. **(1)** (Primers) allow DNA polymerase to attach/start replicating/start copying/add nucleotides (to DNA). **(1)**	**2**	Accept Taq for DNA Answer must indicate link between the primer and DNA polymerase. Accept: DNA polymerase adds nucleotides to primers/them.
		(ii)	DNA polymerase can only add DNA nucleotides in one direction/to the 3′/deoxyribose end of the new strand (which is forming).	**1**	
		(iii)	R	**1**	
		(iv)	(DNA) ligase	**1**	
	(b)	(i)	25	**1**	
		(ii)	To separate the (DNA) strands. **OR** To break the hydrogen bonds/bonds between the bases/strands (in DNA).	**1**	Accept: to denature the DNA.
		(iii)	Allows primers to bind (to DNA/target sequences/ complementary nucleotides).	**1**	Accept: anneal for bind

Question			Expected response	Max mark	Additional guidance
4.	(a)		Substrate and enzyme (with no inhibitor present).	**1**	Accept: any named substrate with its correct enzyme
	(b)		Inhibitor B Increasing the substrate concentration does not reverse inhibition. **OR** Concentrations of above 0·4 M /high substrate concentrations have no effect on/do not increase the rate of reaction.	**1**	
	(c)		36	**1**	
	(d)		50	**1**	
	(e)	(i)	Type of reaction – Anabolic **(1)** Reason - The reaction involves the build-up of molecules/substrates. **OR** Small molecules are built-up/ combined into a large molecule. **(1)**	**2**	Accept synthesis Only accept synthesis in place of build-up if anabolic is given as the type of reaction.
		(ii)	(When the substrate binds) the shape of the active site changes. **(1)** This brings substrate molecules closer together/closer to the active site. **OR** This weakens/breaks chemical bonds. **OR** This lowers the activation energy/ energy needed to start the reaction. **(1)**	**2**	

Question			Expected response	Max mark	Additional guidance
5.	(a)		Drug/inhibitor binds to the (proton) pump/protein **AND** changes the shape of the (proton) pump/protein/ proton attachment site/active site. **(1)** (This means that) protons cannot attach to the (proton) pump/protein **OR** Protons cannot be pumped into the stomach/across the membrane. **(1)**	**2**	
	(b)	(i)	They would be allocated/assigned randomly. **OR** Example describing random allocation.	**1**	Examples could be drawing names out of a hat or using a computer program to allocate them.
		(ii)	Between 0 and 4 hours acid production decreased and then it increased from 4 to 8 hours. **(1)** It decreased from 190 to 60 cm^3/ by 130 cm^3. **OR** It increased from 60 to 110 cm^3/by 50 cm^3. **(1)**	**2**	Accept it decreases for 4 hours and then increases. Must state hours at least once. Must state cm^3 at least once.
		(iii)	The lowest acid volume/reading might have been at a different time between 2 and 6 hours/not been exactly at 4 hours. **OR** The acidity is only checked every 2 hours (so the time when the drug is most effective may be missed).	**1**	
	(c)		(Hydrogen ions) are pumped across the (inner) mitochondrial membrane. **(1)** They flow (back) through ATP synthase (generating ATP). **(1)**	**2**	

Question			Expected response	Max mark	Additional guidance
6.	(a)		Hypothalamus	**1**	
	(b)		Stimulates the development of a follicle. **OR** Stimulates the production of oestrogen (by the follicle).	**1**	
	(c)		63	**1**	
	(d)		Luteal	**1**	
	(e)		(Lack of LH) causes degeneration/ break down of the corpus luteum. **(1)** (This leads to) a decrease in progesterone levels (triggering menstruation). **(1)**	**2**	
	(f)		Cycle starts to repeat/repeats between days 28 and 36. **OR** After 28 days the cycle starts to repeat/repeats. **OR** The changes in days 28 to 36 are the same as days 0 to 8.	**1**	
	(g)		They prevent the negative feedback of oestrogen on FSH secretion. **OR** They mimic the action of FSH/LH.	**1**	

Question			Expected response	Max mark	Additional guidance
7.	(a)	(i)	Autosome	**1**	
		(ii)	P/the grandfather has passed the condition to R/his son.	**1**	
		(iii)	75%	**1**	
		(iv)	Twins	**1**	
	(b)		Cholesterol is deposited in the arteries (by LDL) **OR** Cholesterol cannot be deposited in the cells (by LDL). **(1)** Atherosclerosis occurs/atheromas form/plaques form (increasing blood pressure). **OR** Artery lumen (diameter) narrows/arteries narrow/arteries lose elasticity (increasing blood pressure). **(1)**	**2**	
	(c)	(i)	Statins	**1**	
		(ii)	Regular physical activity/it increases HDL levels/increases the ratio of HDL to LDL. **OR** Regular physical activity/it decreases the ratio of LDL to HDL. **(1)** This lowers (blood) cholesterol levels/concentrations. **(1)**	**2**	Not acceptable: regular physical activity lowers LDL levels.

<table>
<tr><th colspan="3">Question</th><th>Expected response</th><th>Max mark</th><th>Additional guidance</th></tr>
<tr><td>8.</td><td>(a)</td><td>(i)</td><td>Speed of treadmill.
OR
Length of time of exercise (at each level).
OR
Time between exercising at each level.</td><td>1</td><td>Accept temperature of room.

Accept resting heart rate before exercising at each level.</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Repeat the investigation at all gradients.
OR
Repeat the investigation with more individuals.
OR
Repeat the investigation and calculate an average.</td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>95</td><td>1</td><td>Accept 95 only.</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Axes have correct scale and labels. (1)

Points correctly plotted and line drawn. (1)

<table><tr><th>Treadmill gradient</th><th>Cardiac output (litres/min)</th></tr><tr><td>0</td><td>8·6</td></tr><tr><td>2</td><td>9·8</td></tr><tr><td>4</td><td>12·4</td></tr><tr><td>6</td><td>16·6</td></tr><tr><td>8</td><td>17·4</td></tr><tr><td>10</td><td>17·6</td></tr></table></td><td>2</td><td>Scales using one large box for gradients of 2 on the X-axis are acceptable.

Any 3 values to establish a linear scale. A number at the origin is not essential.
Data can be plotted outwith the numbered scale.
Scale breaks are not acceptable.

If the axes are transposed do not award the scale mark.

Gradient alone is acceptable for the X-axis label.

The line must go through all points.</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>As intensity of exercise increases cardiac output increases.</td><td>1</td><td>Not acceptable: as treadmill gradient increases cardiac output increases.</td></tr>
<tr><td></td><td>(c)</td><td></td><td>The time for blood filling the heart/ ventricles decreases.
OR
Less/a smaller volume of blood is able to enter the heart/ventricles.
OR
The heart rate was too high to allow the heart/ventricles to fully fill with blood.</td><td>1</td><td></td></tr>
</table>

Question			Expected response	Max mark	Additional guidance
9.	(a)		A – Dendrite **(1)** B – Synapse/synaptic cleft/ neuromuscular junction **(1)**	**2**	
	(b)		The myelin sheath/myelin/glial cells are attacked/damaged (by the immune system). **(1)** T lymphocytes respond to/attack self-antigens/the body's own cells. **(1)**	**2**	
	(c)		There is a decrease in the speed of impulse transmissions. **OR** Impulses are conducted at a slower rate.	**1**	

Question			Expected response	Max mark	Additional guidance
10.	(a)		X – Peripheral **(1)** Y – Autonomic **(1)**	**2**	
	(b)		They take impulses from sense organs/receptors to the central nervous system/CNS/interneurons.	**1**	Accept brain/spinal cord for CNS.
	(c)		Breathing - It decreases the rate/depth of breathing. **(1)** Digestive system - It increases peristalsis/the production of intestinal secretions/digestive enzymes. **(1)**	**2**	Accept – it increases blood flow to the digestive system.

Question			Expected response	Max mark	Additional guidance
11.	(a)	(i)	Sensory	**1**	
		(ii)	The diagram/it may trigger memories/remind them of when they coloured in/labelled the heart/diagram.	**1**	Not acceptable: general answers that do not relate to this activity.
	(b)		Rehearse/repeat the information (a few times). **(1)** Elaborate on/add more detail/add meaning to the information. **(1)** Organise/sort the information into groups/categories. **(1)** Elaboration is (an example of) a deep form of encoding. **OR** Rehearsal is (an example of) a shallow form of encoding. **(1)** **Any 3 from 4**	**3**	Candidates can be awarded one mark for use of the three terms rehearsal, elaboration and organisation where there are no marks awarded for descriptions.

Question			Expected response	Max mark	Additional guidance
12.	(a)		4797	**1**	
	(b)	(i)	Similarity - both increase (from 2013/14) to 2014/15. **OR** Both decrease from 2014/15 to 2015/16. **OR** Both peak/highest in 2014/15. **(1)** Difference - England increases between 2015/16 and 2016/17 while Scotland decreases. **OR** There are always more deaths in England/fewer deaths in Scotland. **(1)**	**2**	Not acceptable: they are both high in 2014/15.
		(ii)	Express the data as death rates. **OR** Produce figures per same number of people in each country. **OR** Relate the number of deaths to the size of populations in each country. **OR** Produce figures by dividing the number of deaths by (the size of) the populations of each country.	**1**	Accept examples of numbers; eg per 100 000.
		(iii)	9 : 100	**1**	
	(c)		9750	**1**	
	(d)		It alters/changes its antigens/ surface proteins. **OR** It undergoes antigenic variation.	**1**	
	(e)		Epithelial	**1**	

Question			Expected response	Max mark	Additional guidance
13.	(a)	(i)	Reduced uptake of the vaccine/ vaccine rejection. **OR** Herd immunity threshold for the disease not reached in these years. **OR** Reduced effectiveness of the vaccine. **OR** Antigenic variation of the bacteria. **OR** Mutation of the bacteria.	**1**	
		(ii)	104·76/104·8/105	**1**	
	(b)		The vaccine/it contains inactivated/ killed/weakened pathogens. **OR** The vaccine/it contains inactivated toxins from the pathogens.	**1**	Accept virus or bacteria for pathogens. Accept contains attenuated pathogens.
	(c)		Adjuvant	**1**	

Question			Expected response	Max mark	Additional guidance
14.	A		1. Antenatal screening identifies the risk of a disorder (so that further tests/a prenatal diagnosis can be offered). 2. Ultrasound imaging is offered between 8 and 14 weeks and between 18 and 20 weeks. 3. The dating/8 to 14 weeks scan determines pregnancy stage and due date. 4. The anomaly/18 to 20 weeks scan may detect physical abnormalities in the fetus. 5. Marker chemicals (which vary normally during pregnancy) are tested for. 6. Blood/urine tests are carried out regularly during pregnancy. 7. Measuring a chemical at the wrong time could lead to a false positive result. 8. An atypical/abnormal chemical concentration can lead to diagnostic testing. 9. Amniocentesis/chorionic villus sampling (CVS) (used to diagnose a range of genetic conditions). 10. CVS can be carried out earlier in pregnancy than amniocentesis, although it has a higher risk of miscarriage. **OR** Amniocentesis is carried out later in pregnancy but has a lower risk of miscarriage than CVS. 11. Cells (from samples) can be cultured/grown to produce a karyotype. 12. A karyotype shows an individual's chromosomes arranged as homologous pairs. 13. There are risks/decisions to consider before proceeding with diagnostic tests/these tests. **Any 9 from 13**	**9**	For points 2, 3 and 4, accept any number between 8 and 14 for the dating scan and any number between 18 and 20 for the anomaly scan. Point 8: Accept a specific example of a substance/chemical tested for. Point 13: Accept specific examples of risks/decisions.

Question			Expected response	Max mark	Additional guidance
14.	B		1. Arteries/veins/capillaries/blood vessels have a central lumen lined with endothelial cells/endothelium. 2. Arteries/veins have a middle layer containing smooth muscle and elastic fibres. 3. Arteries/veins have an outer layer of connective tissue containing elastic fibres. 4. Veins have a thinner muscle layer/muscular wall than arteries. **OR** Arteries have a thicker muscle layer/muscular wall than veins. 5. Veins contain valves to prevent the backflow of blood/to allow blood to flow in one direction. 6. The elastic walls of the arteries (stretch/recoil) to accommodate/ tolerate the surge/pulse of blood from the heart. 7. Artery (smooth) muscle contracts causing vasoconstriction/relaxes causing vasodilation. 8. Vasoconstriction/vasodilation controls blood flow through the artery. 9. Blood circulates/travels from the heart through the arteries to the capillaries then to the veins and back to the heart. 10. There is a decrease in blood pressure as blood moves away from the heart. **Maximum 8 marks from points 1 to10** 11. Capillaries allow exchange of substances with tissues/(body) cells through their thin walls. 12. Pressure filtration causes plasma to pass through capillary walls into the tissue fluid (surrounding the cells). 13. The plasma (leaving the capillary)/tissue fluid can exchange oxygen/glucose/ carbon dioxide/ (metabolic) waste. **To achieve full marks must have one from points 11 to 13**	**9**	Point 10: Accept: Blood pressure is higher in arteries compared to veins **OR** Blood pressure is lower in veins compared to arteries

[END OF MARKING INSTRUCTIONS]