



National  
Qualifications  
2018

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# **2018 Human Biology**

## **Higher**

### **Finalised Marking Instructions**

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## General marking principles for Higher Human Biology

*This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.*

- (a) Marks for each candidate response must **always** be assigned in line with these general marking principles and the detailed marking instructions for this assessment.
- (b) Marking should always be positive. Marks should be awarded for what is correct and not deducted for errors or omissions.
- (c) If a specific 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 should seek guidance from your team leader.
- (d) There are no half marks awarded.
- (e) Where a candidate makes an error in the first part of a question, credit should normally be given for subsequent answers that are correct with regard to this original error. Candidates should not be penalised more than once for the same error.
- (f) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including units, if appropriate) on its own.
- (g) Bulleted lists should not be used for extended response questions. Candidates must respond to the “command” word as appropriate and write extended answers in order 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.
- (h) In the detailed marking instructions, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.
- (i) In the detailed marking instructions, words separated by / are **alternatives**.
- (j) A correct answer can be negated if:
  - an extra, incorrect, response is given
  - additional information that contradicts the correct response is included.
- (k) Where the candidate is instructed to choose one question to answer but instead answers both questions, both responses should be marked and the better mark awarded.
- (l) Unless otherwise required by the question, use of abbreviations (eg DNA, ATP) or chemical formulae (eg CO<sub>2</sub>, H<sub>2</sub>O) are acceptable alternatives to naming.
- (m) 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, candidates should not be penalised repeatedly.
- (n) Incorrect spelling is given. Sound out the word(s).
  - If the correct word is recognisable then give the mark.
  - If the word can easily be confused with another biological term then **do not** give the mark eg glucagon and glycogen.

(o) **Presentation of data:**

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

(p) Marks are awarded only for a valid response to the question asked. For example, in response to questions that ask candidate 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

### Section 1

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

## Section 2

Question			Expected response	Max mark	Additional guidance
1.	(a)	(i)	Cytoplasm	1	
		(ii)	<p>(Two) ATP (molecules) are used.</p> <p><b>OR</b></p> <p>ATP provides phosphate (to phosphorylate glucose/intermediates).</p> <p><b>OR</b></p> <p>Phosphorylation of glucose/intermediates occur.</p>	1	<p>Do not accept ATP molecules are invested.</p> <p>Accept ATP is converted/ broken down to ADP and Pi.</p> <p>Any mention of net gain of ATP / production of ATP negates.</p>
	(b)	(i)	NADH / NADH <sup>+</sup>	1	Accept NADH <sub>2</sub>
		(ii)	<p>NAD allows ATP production (during glycolysis).</p> <p><b>OR</b></p> <p>NAD allows glycolysis to continue.</p> <p><b>OR</b></p> <p>NAD accepts / collects / carries hydrogen / hydrogen ions.</p> <p><b>OR</b></p> <p>NAD allows dehydrogenase enzymes to function.</p>	1	<p>Do not accept so NAD can be reused.</p> <p>Do not accept NAD removes hydrogen / hydrogen ions.</p> <p>Accept NAD is reduced (to NADH)</p> <p>Any mention of the electron transport chain/citric acid cycle/next stage negates.</p>
		(iii)	Not enough / no oxygen (reaches the muscle cells).	1	Accept conditions become anaerobic / an oxygen debt has built up.

Question			Expected response	Max mark	Additional guidance														
2.	(a)		Any <b>two</b> from: <ul style="list-style-type: none"><li>• mass/weight/surface area/size/ type of liver;</li><li>• volume of inhibitor / alcohol / solution;</li><li>• <u>initial</u> alcohol concentration;</li><li>• pH of <u>solution</u>;</li><li>• type of alcohol / inhibitor.</li></ul>	2	If candidate lists three or more variables and at least one is correct they can be awarded 1 mark.  Do not accept size of test tube.  Do not accept ‘amount’ but do not penalise twice if used in both responses.  Do not accept ‘alcohol concentration’.														
	(b)		It binds elsewhere (on the enzyme) / the allosteric site / not to the active site and changes the shape of the <u>active site</u> .	1	Use of denatures negates.														
	(c)	(i)	Axes have correct scales and labels. (1)  Points correctly plotted and line drawn. (1) <table border="1"><thead><tr><th>Inhibitor concentration (mM)</th><th>Final alcohol concentration (% of initial concentration)</th></tr></thead><tbody><tr><td>0.5</td><td>20</td></tr><tr><td>1.5</td><td>28</td></tr><tr><td>2.5</td><td>60</td></tr><tr><td>3.5</td><td>96</td></tr><tr><td>4.5</td><td>100</td></tr><tr><td>5.5</td><td>100</td></tr></tbody></table>	Inhibitor concentration (mM)	Final alcohol concentration (% of initial concentration)	0.5	20	1.5	28	2.5	60	3.5	96	4.5	100	5.5	100	2	Candidate cannot access the scale mark if the plotted points use less than half of the graph paper.  If the scales start at zero there must be a zero entered. A common zero is acceptable if both scales start at zero. The scales do not have to start at zero but final number must be equal to or above 5.5mM and equal to 100%.  If the axes are transposed the candidate loses the scale mark.  Line must go through all points.  If all points correctly plotted, assume horizontal line between 4.5 and 5.5 is correct.
Inhibitor concentration (mM)	Final alcohol concentration (% of initial concentration)																		
0.5	20																		
1.5	28																		
2.5	60																		
3.5	96																		
4.5	100																		
5.5	100																		
		(ii)	As inhibitor concentration increases (enzyme) <u>activity</u> decreases. (1)  Beyond 4.5 (mM) there is no (enzyme) <u>activity/activity stops/activity levels off/ activity remains constant.</u> (1)	2	Answer must indicate the change happens from 4.5 mM onwards rather than only at 4.5 mM.														

Question			Expected response	Max mark	Additional guidance
2.	(d)		<p>The (final) alcohol concentration will not change / will not decrease / will stay at 100% / will remain high.</p> <p><b>OR</b></p> <p>(Increasing the initial) alcohol/ substrate concentration will have no effect (on the results).</p>	1	<p>Candidates are not expected to state whether they are discussing initial or final alcohol concentration.</p> <p>Do not accept answers in terms of enzyme activity.</p>

Question			Expected response	Max mark	Additional guidance
3.	(a)	(i)	Deletion	1	
		(ii)	<p>The order/sequence of <u>amino acids</u> would change</p> <p><b>OR</b></p> <p><u>Amino acids</u> after the mutation would change</p> <p><b>OR</b></p> <p>The protein is shorter due to the presence of a <u>stop codon</u>.</p>	1	<p>Do not accept one / wrong amino acid is changed.</p> <p>Do not accept stop codon is produced (without reference to shorter protein).</p>
	(b)		Systematics	1	
	(c)	(i)	15 : 5 : 1	1	
		(ii)	<p>The more an animal has the better is its sense of smell.</p> <p><b>OR</b></p> <p>Rats have the best / a better sense of smell because they have most (functional genes/nasal receptors).</p> <p><b>OR</b></p> <p>Chickens have the worst / a poorer sense of smell because they have fewest (functional genes/nasal receptors).</p>	1	Answer must link to number of genes.
	(d)		<p>1. <u>Deletion</u> is the loss of part of a chromosome / genes.</p> <p>2. <u>Duplication</u> is the repeat of a part of a chromosome / genes.</p> <p><b>OR</b></p> <p><u>Duplication</u> - the breaking off of part of a chromosome / genes and it reattaching to its homologous partner.</p> <p>3. <u>Translocation</u> the moving/swapping/ transfer of parts of chromosomes / genes to another chromosome / non-homologous chromosome.</p> <p><b>Any 2 from 3</b></p> <p>4. These mutations/changes can be lethal/be fatal to/kill the individual/life threatening.</p> <p><b>OR</b></p> <p>An example named such as cri-du-chat for deletion, myeloid leukaemia or <u>familial</u> Down's syndrome for translocation. (1)</p>	3	<p>Give 1 mark for naming two types of mutation but providing no / incorrect descriptions.</p> <p>Cannot use the name of the mutation in its description. E.g. deletion is the deletion of genes.</p> <p>Example must be correctly linked to the chromosome mutation.</p>



Question			Expected response	Max mark	Additional guidance
4.	(a)	(i)	5.6 per 100 000	1	
		(ii)	37.5	1	
		(iii)	46	1	
		(iv)	Between 2007 and 2009 there is an increase in breastfeeding while infant mortality continues to increase/does not decrease.	1	Accept 2007 and 2008 or 2008 and 2009 as an alternative to between 2007 and 2009.  Ignore any Y-axis figures.
	(b)	(i)	6	1	
		(ii)	Bottles/water/milk can be contaminated with <u>bacteria</u> / <u>viruses</u> / <u>pathogens</u> / <u>microbes</u> .  <b>OR</b>  Breastfed babies can get <u>antibodies</u> / <u>immunity</u> from their mother.	1	Do not accept germs.
5.	(a)		Medulla (1)  SAN/right atrium (wall)/pacemaker (1)	2	
	(b)		Sympathetic nervous system increases heart rate while parasympathetic system decreases it. (1)  Sympathetic system releases/produces noradrenaline/norepinephrine while the parasympathetic system releases/produces acetylcholine. (1)	2	
	(c)	(i)	60	1	
		(ii)	<u>Ventricles</u> are contracting/pumping blood/ <u>ventricular</u> systole.  <b>OR</b>  Impulses are spreading through the <u>ventricles</u> .	1	Mention of atria contracting negates.

Question			Expected response	Max mark	Additional guidance
6.	(a)		15-44	1	
	(b)	(i)	Statins	1	
		(ii)	2007/2008	1	
	(c)		Component of the cell membrane.  <b>OR</b>  Used to synthesise steroids/sex hormones/testosterone/oestrogen/progesterone.	1	
7.	(a)	(i)	30·68/30·7/31	1	Ignore units.
		(ii)	The office worker has/ they have less muscle/more fat.  <b>OR</b>  The swimmer has more muscle/less fat.	1	A comparison between individuals must be made.  Do not accept 'more muscles'. Accept 'bigger muscles' or more muscular.
	(b)		Cells/receptors have become less sensitive/(more) resistant/desensitised to insulin.  <b>OR</b>  Cells have less insulin receptors. (1)  This means that glucose cannot enter the cells.  <b>OR</b>  This means that glucose cannot be converted to / stored as glycogen.  <b>OR</b>  This means less glucose is converted to / stored as glycogen (1)	2	If the cell is specified accept liver, muscle and fat, but not pancreas.        Accept this means that glucose channels do not open.

Question			Expected response	Max mark	Additional guidance
8.	(a)	(i)	Encoding	1	
		(ii)	Short-term memory has a limited capacity/span /stores only 5-9 pieces of information.	1	Accept any number between 5 and 9.
		(iii)	Information can put into categories/related groups.  <b>OR</b>  Information can have detail/meaning added to it.	1	Candidate must indicate the information in the groups is related / linked.  Accept a correct description of either organisation or elaboration. If these terms are used they must be correctly described.  Use of any incorrect term with correct description (of organisation / elaboration) negates.  Do not accept chunking.
		(iv)	These trigger memories relating to the circumstances/conditions/ environment/stimuli present when the memory was formed.  <b>OR</b>  Suitable example described.	1	e.g. they help you remember as that scent was present when the memory was made.
	(b)		Cerebrum/cerebral cortex	1	Only accept these two terms.

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	It/cars/objects which are further away look/appear/are smaller.  OR  It/cars/objects which are nearer look/appear/are bigger.	1	
		(ii)	The view of cars / objects which are further away is (partially) blocked / screened / obstructed / covered by nearer cars / objects.	1	Answer must convey 'overlapping'.
	(b)		Binocular disparity	1	
	(c)	(i)	16	1	Accept if correct answer is in the table and there is no answer in the answer space.
		(ii)	To prevent them learning the position of the coin.  OR  To prevent them remembering where the coin was.  OR  To make sure that the experiment / results were valid.	1	The use of reliable or accurate negates any answer.  Accept so student did not know where the coin would be / where to place their finger  Accept to prevent them creating a motor pathway of where the coin is.
		(iii)	The (student's) left eye is better/more accurate at <u>judging distance</u> .  OR  The (student's) right eye is worse/less accurate at <u>judging distance</u> .	1	

Question			Expected response	Max mark	Additional guidance
10.	(a)	(i)	<p>1. Less/a lower number/a lower percentage of females smoke than males in <u>all age groups</u>.</p> <p><b>OR</b></p> <p>More/a higher number/ a higher percentage of males smoke than females in <u>all age groups</u>.</p> <p>2. The percentage / number of female smokers decreases with age.</p> <p>3. The percentage / number of male smokers increases to 25-34 years <u>and</u> then decreases.</p> <p><b>Any 2 from 3</b></p>	2	<p>Accept there are <u>always</u> less/ a lower number/a lower percentage of female smokers than males.</p> <p>Accept there are <u>always</u> more/a higher number/ a higher percentage of male smokers than females.</p> <p>Do not accept the number /percentage of male smokers decreases from 25-34 years.</p>
		(ii)	Many <u>older smokers</u> have died (from smoking related illnesses).	1	Accept 65+ as older.
	(b)	(i)	<p>Nicotine binds to <u>acetylcholine</u> receptors.</p> <p><b>OR</b></p> <p>Nicotine mimics the action of <u>acetylcholine</u>.</p>	1	Do not accept answers that state neurotransmitter instead of acetylcholine.
		(ii)	<p>Dopamine induces feelings of pleasure/euphoria/makes them feel good.</p> <p><b>OR</b></p> <p>Dopamine stimulates / activates / triggers the reward pathway.</p>	1	Answer must indicate that the reward pathway is activated. Do not accept affects / links to / reinforces the reward pathway on their own.
		(iii)	It causes a decrease in the number/ sensitivity of <u>receptors</u> .	1	Amount is acceptable for number.
	(c)		Individuals <u>identify</u> with the celebrity and stop smoking/change their behaviour/change their beliefs to be like them/as they admire them.	1	<p>Answer must contain identification / identify.</p> <p>Role model/ idol indicates admiration of celebrity.</p>
	(d)		43 000	1	

Question			Expected response	Max mark	Additional guidance
11.	(a)	(i)	There were a high/higher number of cases in 1991 and 1992 / two years.	1	
		(ii)	Endemic	1	
		(iii)	<p>The cases would not occur every year / regularly / constantly.</p> <p><b>OR</b></p> <p>The cases would occur occasionally / randomly / irregularly / less frequently.</p>	1	Do not accept there would be fewer cases, unless qualified.
	(b)	(i)	Individuals who had not been immunised were unlikely to come into contact with infected individuals.	1	<p>Answer must indicate coming into contact with an individual who has the disease and not simply the disease.</p> <p>Do not accept contact with unvaccinated individuals instead of infected individuals.</p>
		(ii)	Due to malnutrition/poverty/rejection by some of the population/lack of education/lack of access to medical resources or vaccines/geographical remoteness.	1	<p>Rejection can include for beliefs and because individuals are allergic to vaccines / immunosuppressed / have a weakened immune system.</p> <p>Accept vaccination may not result in immunity / work.</p> <p>Do not accept health problems.</p>

Question			Expected response	Max mark	Additional guidance
12.	(a)	(i)	Epithelial / epithelium.	1	
		(ii)	They produce secretions / chemicals / mucus / sweat / stomach acid / tears / sebum.	1	pH must be linked to a secretion. Do not accept lowers pH of skin.  Any answer must indicate production / secretion.
	(b)		Chemical: histamine (1)  Explanation: causes vasodilation/ increases capillary permeability (1)	2	Vasodilation of capillaries negates.
	(c)	(i)	Phagocyte: engulfs it/ ingests it / takes it in <u>and</u> digests it / breaks it down. (1)  NK cell: induces/triggers apoptosis of (infected) <u>cell</u> <b>OR</b> induces/triggers production of self-destructive enzymes/self-destruction/programmed <u>cell</u> death (in the infected <u>cell</u> ). (1)	2	Do not accept destroys instead of digests.   Answer must relate to the cell and not the pathogen. If candidate mentions cell assume it is infected e.g. target cell.
		(ii)	They release / produce <u>cytokines</u> .	1	

Question			Expected response	Max mark	Additional guidance
13.	A		<ol style="list-style-type: none"> <li>1. At puberty a (releaser) hormone is produced by the hypothalamus.</li> <li>2. The pituitary gland releases follicle stimulating hormone/FSH <u>and</u> interstitial cell stimulating hormone /ICSH.</li> <li>3. FSH/ICSH acts on/targets the testes.</li> <li>4. FSH stimulates sperm production in the seminiferous tubules.</li> <li>5. ICSH stimulates the production of testosterone in the interstitial cells.</li> <li>6. Testosterone stimulates sperm production.</li> <li>7. Sperm/gametes are produced from germline cells by meiosis.</li> <li>8. Testosterone activates the prostate gland/seminal vesicles.</li> <li>9. Secretions affect/maintain sperm mobility/viability <b>or</b> named example</li> <li>10. Negative feedback control / feedback inhibition of sperm / testosterone production exists.</li> <li>11. High levels of testosterone inhibits/reduces/controls FSH/ICSH production.</li> </ol> <p style="text-align: right;"><b>8 marks from 11</b></p>	<b>8</b>	<p>Accept LH in place of ICSH for point 2 only.</p> <p>Point 11 must refer to the production of FSH / ICSH</p>



Question			Expected response	Max mark	Additional guidance
13.	B		<ol style="list-style-type: none"> <li>1. Drug treatment / fertility drugs are used to stimulate/trigger ovulation/super ovulation.</li> <li>2. (Some) drugs prevent the negative feedback of oestrogen on FSH production.</li> <li>3. Other drugs mimic the effect of FSH/LH.</li> <li>4. Artificial Insemination is used if a man has a low sperm count.</li> <li>5. (Several) sperm/semen samples are collected.</li> </ol> <p><b>OR</b></p> <ol style="list-style-type: none"> <li>6. Sperm/ semen is inserted into the female reproductive tract by means other than sexual intercourse / syringe.</li> <li>7. Intra-cytoplasmic sperm injection/ ICSI is used when man has a low sperm count/when sperm are defective.</li> <li>8. The <u>head</u> of the sperm is (directly) injected/inserted into the egg.</li> <li>9. During In vitro fertilisation/IVF eggs are fertilised outside the body.</li> <li>10. Zygotes/fertilised eggs are incubated.</li> </ol> <p><b>OR</b></p> <p>Blastocysts/ balls of cells/ embryos are transferred into the uterus/womb.</p> <li>11. Pre-implantation genetic diagnosis / PGD identifies genetic disorders/ chromosome abnormalities.</li> <p style="text-align: right;"><b>8 marks from 11</b></p>	<b>8</b>	<p>Accept that ovulatory drugs indicate stimulation of ovulation. Accept medication for drugs.</p> <p>Point 5 Accept sperm is collected over a period of time.</p> <p>Accept vagina / uterus / womb for female reproductive tract</p> <p>Accept descriptions of defective sperm eg mobility problems.</p> <p>Accept zygotes/fertilised eggs divide before being placed in the uterus.</p>

**[END OF MARKING INSTRUCTIONS]**