National
Qualifications
2015

2015 Human Biology

New Higher

Finalised Marking Instructions

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. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of 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 must seek guidance from your Team Leader.

(d) There are no half marks awarded.

(e) Where a candidate makes an error at an early stage in a multi stage calculation, credit should normally be given for correct follow on working subsequent stages, unless the error significantly reduces the complexity of the remaining stages. The same principle should be applied in questions which require several stages of non-mathematical reasoning.

(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) on its own.

(g) Larger mark allocations may be fully accessed whether responses are provided in continuous prose, linked statements or a series of discrete developed points.

(h) In the mark scheme, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.

(i) In the mark scheme, words separated by / are **alternatives**.

(j) If two answers are given that contradict one another the first answer should be taken. However, there are occasions where the second answer negates the first and no marks are given. There is no hard and fast rule here, and professional judgement must be applied.

(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) The assessment is of skills, knowledge and understanding in Human Biology, so marks should be awarded for a valid response, even if the response is not presented in the format expected. For example, if the response is correct but is not presented in the table as requested, or if it is circled rather than underlined as requested, give the mark.

(m) Unless otherwise required by the question, use of abbreviations (eg DNA, ATP) or chemical formulae (eg CO_2, H_20) are acceptable alternatives to naming.

(n) Content that is outwith the course assessment specification should be given credit if used appropriately eg metaphase of meiosis.

(o) 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.

(p) Incorrect **spelling** is given: sound out the word(s):

- if the correct item is recognisable then give the mark
- if the word can easily be confused with another biological term then **do not** give the mark eg ureter and urethra
- if the term is a mixture of other biological terms then **do not** give the mark, eg mellum, melebrum, amniosynthesis

(q) Presentation of data:

- if a candidate provides two graphs or bar charts, in response to one question (eg one in the question and another at the end of the booklet), mark both and give the higher score
- for marking purposes no distinction is made between bar charts (used to show discontinuous features, have descriptions on the x-axis and have separate columns) and histograms (used to show continuous features, have ranges of numbers on the x-axis and have contiguous columns)
- other than in the case of bar charts/histograms, if the question asks for a particular type of graph or chart and the wrong type is given, then do not give the mark(s) for this. Where provided, marks may still be awarded for correctly labelling the axes, plotting the points, joining the points either with straight lines or curves (best fit rarely used), etc.
- the relevant mark should not be awarded if the graph uses less than 50% of the axes; if the x and y data are transposed; if 0 is plotted when no data for this is given (ie candidates should only plot the data given)

(r) 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 name or present in brief form;
- **describe**, they must provide a statement or structure of characteristics and/or features;
- **explain**, they must relate cause and effect and/or make relationships between things clear;
- **compare**, they must demonstrate knowledge and understanding of the similarities and/or differences between things;
- **calculate**, they must determine a number from given facts, figures or information;
- **predict**, they must suggest what may happen based on available information;
- **evaluate**, they must make a judgement based on criteria;
- **suggest**, they must apply their knowledge and understanding of Human Biology to a new situation. Marks will be awarded for any suggestions that are supported by knowledge and understanding of Human Biology

Detailed Marking Instructions for each question

Section 1

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

Section 2

Question			Expected Answer(s)	Max Mark	Additional Guidance
1.	(a)		(Relatively) unspecialised (cells) **or** Capable of (repeated) division **or** Can differentiate (into specialised cells) **or** Are totipotent.	**1**	Accept undifferentiated (cells) Accept can divide by mitosis Accept can develop/specialise into / become any cell.
	(b)		Embryonic stem cells/inner cell mass cells can form all cells types /are totipotent or pluripotent. while tissue/adult stem cells can only form a limited range of cell types /are multipotent.	**1**	Answer must give a comparison between the two types of cells. Accept – tissue stem cells can only form cells from the tissues they are found in.
	(c)	(i)	Tissue / stem cells are cultured/ grown (in laboratory/outside body). **or** Tissue/stem cells are transplanted/placed into the muscle/tissue/damaged area.	**1**	Do not accept skin grafts. Do not accept 'into the body'.
		(ii)	Stem cells can be used to study diseases/cancer. **or** Stem cells can be used for drug/ medicine testing/treatment.	**1**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
2.	(a)		Anabolic/synthetic/biosynthetic /synthesis	**1**	
	(b)	(i)	It will contain a different nucleotide/base. **or** It will contain a different codon /stop codon.	**1**	Accept a specific description of a gene mutation. eg insertion of a nucleotide/base. Accept a description of missense, nonsense or splice-site mutations e.g. substitution of a nucleotide/ base.
		(ii)	The protein/enzyme/glycogen synthase contains a different amino acid(s).	**1**	Accept 'shorter protein/ polypeptide produced' if linked to stop codon (in bi).
	(c)		Glucose is used up in respiration/to provide energy/ ATP and they have no glycogen stores to provide more glucose.	**1**	Do not accept glucose is used up in exercise. Accept glycogen is not converted to glucose.
	(d)		*Recessive* Disease skips generations/does not appear in every generation. **or** Two unaffected/heterozygous/ carrier parents can have an affected child. *1 mark* *Sex-linked* **More males** will be affected than females. **or** **Affected males** do not pass the allele/condition to their sons. **or** **Affected males** can only pass the allele/condition to their daughters. **or** **Unaffected males** cannot pass the allele/condition to their daughters. **or** Only **affected/carrier females** pass the condition to their sons. *1 mark*	**2**	Accept homozygous recessive for affected child. Do not accept 'only males are affected'. Accept all males that have the allele will be affected.

Question			Expected Answer(s)	Max Mark	Additional Guidance
3.	(a)		Volume of yeast suspension/ solution/cells. Concentration of yeast suspension/solution/number of yeast cells/mass of yeast. Type/age/source of yeast cells. Area/size/diameter/volume/ thickness/type of gel or dish. Concentration of nutrients in gel/pH of gel. Strength or intensity of lamp/use same lamp/ distance of lamp. Temperature of incubator/ dishes. Time for yeast to grow/dishes left in incubator. *Any two*	**2**	Do not accept amount but do not penalise twice if used in both answers. Do not accept quantity. Accept mass of gel. Do not accept temperature on its own.
	(b)	(i)	Axes have correct scales and labels – *1 mark* Points correctly plotted and line drawn (touching each point). – *1 mark*	**2**	Remove 1 mark if less than half the graph paper is used. Remove 1 mark if axes are transposed. Remove 1 mark if no zero at the origin. One common zero is acceptable.
		(ii)	Increasing the exposure (to UV radiation) <u>increases</u> the number of yeast cells/colonies that <u>die</u>/are <u>damaged</u>. **Or** Increasing the exposure (to UV radiation) <u>decreases</u> the number of yeast cells/colonies that <u>survive</u>.	**1**	Answer referring to the number of yeast cells <u>growing</u> is wrong <u>unless</u> there is a further correct reference to cells that die/are damaged/survive. Accept DNA damage as cell damage.
		(iii)	Repeat the investigation <u>at each exposure</u> (time). **Or** Repeat the investigation and calculate <u>averages</u>.	**1**	Do not accept repeat the results/ measurements.
	(c)	(i)	400	**1**	
		(ii)	The number of yeast cells/ colonies at SPF 15 is almost as much as with higher SPF values. **Or** There are more yeast cells/ colonies using SPF 15 compared to when using no sunscreen.	**1**	Do not accept more yeast cells/ colonies using SPF 15 compared to SPF 6. Accept figures for more (72) and none (15).
		(iii)	350 minutes/5 hours 50 minutes	**1**	Units are essential.

Question			Expected Answer(s)	Max Mark	Additional Guidance
4.	(a)		ATP is broken down/used up/ converted to ADP. **Or** ATP is put into the reaction.	**1**	Accept phosphorylation of intermediates/glucose/fructose 6 phosphate. Do not accept phosphorylation occurs on its own. Do not accept ATP is invested.
	(b)		It changes the shape/form of the active site (to suit the substrate molecule). **Or** It induces a better fit with the substrate. **Or** It lowers the activation energy.	**1**	Do not accept references to inhibitors. Accept it increases the enzyme's affinity for the substrate.
	(c)		Enzyme 1 **or** Enzyme 3 Explanation: The transfer of phosphate/ addition of phosphate (from ATP)	**1**	Accept underlining/ticking.
	(d)		When there has been a build-up/ too much/an increased concentration of fructose-6-phosphate.	**1**	
	(e)		This ensures the cell only produces ATP when required **or** This ensures that glucose is only used when it is required/ conserved.	**1**	Do not accept 'conserves energy/ ATP'. Accept excess ATP not produced.
5.	(a)	(i)	Releases/ supplies energy (rapidly / at a fast rate). *1 mark* Phosphate (released) is used to convert ADP to ATP/to create ATP. *1 mark*	**2**	This can refer to creatine phosphate or ATP. Do not accept creatine phosphate for phosphate. Accept creatine phosphate is used to phosphorylate ADP.
		(ii)	The creatine phosphate supply runs out (after 10 seconds).	**1**	Accept there is a limited supply of creatine phosphate.
	(b)		Lactic acid/lactate.	**1**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
5.	(c)		Muscle fibre: Slow twitch Sport: any suitable endurance sport Reasons: • they contract (relatively) slowly • can contract over a (relatively) long period • have many mitochondria • have a large blood supply • rely on aerobic respiration (to generate ATP) • have a high concentration of myoglobin • stores/energy source is mainly fat. Muscle fibre: Fast twitch Sport: any sport requiring bursts of energy Reasons – • they contract (relatively) quickly • can contract over a (relatively) short period • have few mitochondria • have a low blood supply • rely on glycolysis (to generate ATP) • have a low concentration of myoglobin • stores/main energy source is glycogen/creatine phosphate. *Any 3 reasons for 3 marks.*	**3**	Annotate answer with ticks. *Remove 1 mark if wrong type of muscle fibre is picked for chosen sport.* Accept <u>any</u> comparison with fast twitch e.g. contains more mitochondria. Accept <u>any</u> comparison with slow twitch eg they have a lower blood supply.

Question			Expected Answer(s)	Max Mark	Additional Guidance
6.	(a)	(i)	Cross (centre) is placed in the fetal tissue area.	**1**	Accept if cross is placed on the placenta in the main diagram.
		(ii)	Cells are cultured/allowed to divide (to obtain sufficient cells) *1 mark* (Karyotypes then show) the <u>chromosomes</u> (from the cells). *1 mark*	**2**	Candidates can get these marks if discussing amniocentesis. Do not accept cells are amplified.
		(iii)	CVS can be carried out earlier (in pregnancy than amniocentesis).	**1**	Answer must show a length of time comparison.
	(b)		Biochemical	**1**	
7.	(a)		18	**1**	
	(b)		(As children get older) they eat less 'healthy' food/have a higher fat diet/have more sugar in their diet. **Or** (As children get older) they choose/control what they eat. **Or** (As children get older) they exercise less/carry out less physical activities.	**1**	Do not accept have a worse diet. Do not accept children eat more.
	(c)		Weight divided by height <u>squared</u>.	**1**	
	(d)		Identification – use celebrities/ role models/someone they admire to promote a healthy lifestyle/healthy diet / exercise. 1 mark Internalisation – Use adverts/ media/parents/reasoned arguments/persuasion to get children to adopt a healthy lifestyle/healthy diet/exercise. 1 mark	**2**	If the idea of a) use celebrities/role models/someone they admire <u>and</u> b) Use adverts media/ parents/reasoned arguments/persuasion are <u>both</u> given correctly but there is no mention of lifestyle/ eating habits/exercise - *1 mark* Do not accept to promote/ encourage a healthy BMI.

Question			Expected Answer(s)	Max Mark	Additional Guidance
8.	(a)		Between work levels 1 to 5 the stroke volume increased and then it remained constant between levels 5 and 7. *1 mark* It increased from 88 cm^3 to 140 cm^3 **or** it remained constant at 140 cm^3. *1 mark*	**2**	Accept – stroke volume increases up to work level 5 and then levels out. Correct units needed at least once.
	(b)		102	**1**	
	(c)		19 600	**1**	
	(d)	(i)	4·5	**1**	
		(ii)	120 beats/min	**1**	Units are essential. bpm is acceptable.
		(iii)	23·81/23·8/24	**1**	
9.	(a)		Enough / increased/more/a higher concentration of dopamine /neurotransmitter (is released) to trigger an impulse/reach threshold. **or** Many/a series of weak stimuli trigger an impulse/reach threshold.	**1**	Do not accept weak impulses instead of stimuli.
	(b)		Provides energy/ATP to make/ release neurotransmitter or dopamine/form vesicles/allow vesicles to move/allow vesicles to fuse with the membrane/to reuptake neurotransmitter.	**1**	
	(c)		(Cocaine) blocks/inhibits/acts as an antagonist to the re-uptake proteins. **or** (Cocaine) prevents the proteins from reabsorbing/taking up/ removing dopamine. *1 mark* Dopamine/neurotransmitter remains in the synapse/at the receptors. **or** Dopamine/neurotransmitter continues to stimulate receptors/fire impulses. *1 mark*	**2**	Do not accept cocaine binds to/ attaches to the re-uptake proteins. Do not accept agonist. Do not accept dopamine continues to stimulate the reward pathway.

Question			Expected Answer(s)	Max Mark	Additional Guidance
10.	(a)		Organisation Related information is grouped together. **Or** Information is put into categories /headings. *1 mark* Elaboration Additional information is given (about each term). **Or** Meaningful information is given (about each term). *1 mark*	**2**	Names of both methods are correct but incorrect descriptions are given – award 1 mark. Do not accept - put the information into groups. Do not accept put information into a story / into context. If elaboration of meaning is given as the method, the description must still indicate meaning to gain the mark.
	(b)		Short-term memory/STM has a limited capacity/span/only holds around 7 items of information.	**1**	Accept anything between 5 and 9 items. Mention of time (30s) does not negate.
	(c)		Cerebrum/cortex	**1**	
11.	(a)	(i)	Release histamine *1 mark* This causes vasodilation/ increased capillary permeability *1 mark* **Or** Release cytokines *1 mark* This leads to an accumulation of phagocytes/the delivery of antimicrobial proteins/clotting elements *1 mark*	**2**	Accept a description of vasodilation e.g. blood vessels widen. Do not accept vasodilation of capillaries. Accept this attracts phagocytes.
		(ii)	NK cells induce/cause the infected/invaded cell to self-destruct/undergo apoptosis/ undergo programmed cell death. *1 mark*	**1**	
	(b)		Phagocytes engulf/capture/ digest the bacteria/pathogen. *1 mark* They display the bacteria's/ pathogen's antigens on their surface (activating T-lymphocytes). *1 mark*	**2**	Do not accept phagocytes engulf antigens/invaders/foreign cells. Do not accept phagocytes destroy pathogens. Accept phagocytes destroy pathogens by phagocytosis. Accept – they become antigen presenting cells if it is linked to engulfing the pathogen.

Question			Expected Answer(s)	Max Mark	Additional Guidance
12.	(a)		26 million/26 000 000	**1**	
	(b)		0·6 million/600 000	**1**	
	(c)		5·14/5·1/5	**1**	
	(d)		The steepest/steeper part of the (HIV infected) graph/line was between 1993 and 1995 **Or** The graph/line sharply increases between 1993 and 1995 while the rest of the graph/line more steadily increases.	**1**	Do not accept the greatest increase occurs between 1993 and 1995. The answer must refer to the gradient of the line, so greatest slope is acceptable. The answer must indicate a comparison to other areas. So it rises steeply between 1993 and 1995 is not correct.
13.	(a)	(i)	Each group should contain individuals of similar ages/a similar age range. **or** Each group should contain the same number of males and females/same gender mix. **or** Individuals in groups should have no recent history of influenza. **or** Individuals should not be allowed to travel abroad during the study **or** Individuals should all be in good general health.	**1**	
		(ii)	Did not develop influenza = 453 and Total = 470	**1**	
		(iii)	R	**1**	
	(b)		It enhances/improves the immune response/antibody production. **or** It improves the effectiveness of the vaccine.	**1**	Accept it makes the immune response work better/last longer. Accept it makes the vaccine work better/longer. Do not accept - it enhances the vaccine/speeds up the immune system.
	(c)		A pandemic	**1**	

Question			Expected Answer(s)	Max Mark	Additional Guidance
14.	(a)	(i)	1. Pituitary gland secretes/ produces FSH/LH. 2. FSH stimulates growth of <u>follicle</u> (in the ovary). 3. Follicle/ovary produces oestrogen. 4. Oestrogen stimulates growth/ repair/proliferation/ thickening of endometrium/ uterus lining. 5. Oestrogen stimulates production of LH. 6. LH (surge) brings about ovulation/release of the egg. 7. <u>Rising/high levels</u> of oestrogen inhibit FSH production. 8. This is negative feedback	**6**	Any 6 from 8 Do not accept oestrogen causes vascularisation.
		(ii)	a. The follicle develops into the corpus luteum. b. Corpus luteum secretes progesterone (and oestrogen). c. Progesterone maintains/ increases/thickens the endometrium/uterus lining. d. Progesterone inhibits <u>FSH/ LH</u> production. e. Progesterone/oestrogen levels decrease (towards the end of the cycle). f. This/corpus luteum degeneration triggers menstruation/breakdown of the endometrium.	**4**	Any 4 from 6 Do not accept progesterone <u>repairs</u> the endometrium. Accept – progesterone causes vascularisation of the endometrium/uterus lining. Note – point 8 may be awarded here if negative feedback is linked to point d.

Question			Expected Answer(s)	Max Mark	Additional Guidance
14	(b)	(i)	1. Pacemaker/SAN contains autorhythmic cells/is where the heart beat originates/is found in the right atrium. 2. Impulse/wave of excitation spreads across the atria/cause the atria to contract/cause atrial systole. 3. (Impulses) reach/stimulate the atrioventricular node/ AVN. 4. AVN found at junction of atria and ventricles/at base of atria. 5. Impulses from AVN spread through ventricles. 6. (Cause) contraction of ventricles/ventricular systole. 7. (This is followed by) relaxation/resting/diastolic phase/diastole.	**5**	Any 5 from 7 Check blood flow answers carefully as candidates can get points 6 and 7.
		(ii)	a. Medulla controls the cardiac cycle/regulates the SAN. b. Autonomic nervous system (carries impulses to heart). c. Sympathetic nerve speeds up the heart rate. d. Sympathetic nerve releases noradrenaline/norepinephrine. e. Parasympathetic nerve slows down the heart rate. f. Parasympathetic nerve releases acetylcholine. g. Sympathetic and parasympathetic systems are antagonistic to each other	**5**	Any 5 from 7 Give 1 mark (h) if candidate mentions sympathetic and parasympathetic but no/wrong description of speeds up and slows down. Give 1 mark (i) if candidate mentions noradrenaline and acetylcholine but no/wrong link to sympathetic and parasympathetic nerves.

[END OF MARKING INSTRUCTIONS]