



2014 Human Biology

Higher (Revised)

Finalised Marking Instructions

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Part One: General Marking Principles for Human Biology Higher (Revised)

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 specific Marking Instructions for each question.

- (a) Marks for each candidate response must always be assigned in line with these general marking principles and the specific Marking Instructions for the relevant question. 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/Principal Assessor.
- (b) Marking should always be positive ie, marks should be awarded for what is correct and not deducted for errors or omissions.

GENERAL MARKING ADVICE Human Biology Higher (Revised)

The marking schemes are written to assist in determining the “minimal acceptable answer” rather than listing every possible correct and incorrect answer. The following notes are offered to support Markers in making judgements on candidates’ evidence, and apply to marking both end of unit assessments and course assessments.

1. There are no **half marks**. Where three answers are needed for two marks, normally one or two correct answers gain one mark.
2. In the mark scheme, if a word is **underlined** then it is essential; if a word is **(bracketed)** then it is not essential.
3. In the mark scheme, words separated by/are **alternatives**.
4. 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. Good marking schemes should cover these eventualities.
5. Where questions on data are in two parts, if the second part of the question is correct in relation to an incorrect answer given in the first part, then the mark can often be given. The general rule is that candidates should not be penalised repeatedly.
6. 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.
7. Clear indication of understanding is what is required, so:
 - if a description or explanation is asked for, a one word answer is not acceptable
 - if the questions ask for **letters** and the candidate gives words and they are correct, then give the mark
 - if the question asks for a word to be **underlined** and the candidate circles the word, then give the mark
 - if the result of a calculation is in the space provided and not entered into a table and is clearly the answer, then give the mark
 - **chemical formulae** are acceptable eg CO₂, H₂O
 - contractions used in the Arrangements document eg DNA, ATP are acceptable
 - words not required in the syllabus can still be given credit if used appropriately eg metaphase of meiosis.

8. 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 word is a mixture of other biological words then **do not** give the mark, eg mellum, melebrum, amniosynthesis.
9. **Presentation of Data:**
- if a candidate provides two graphs or bar charts (eg one in the question and another at the end of the booklet), mark both and give the higher score
 - if the question asks for a line graph and a histogram or bar chart is given, then do not give the mark(s). Credit can be given for labelling the axes correctly, plotting the points, joining the points either with straight lines or curves (best fit is rarely used)
 - if the x and y data are transposed, then do not give the mark
 - if the graph used less than 50% of the axes, then do not give the mark
 - if 0 is plotted when no data is given, then do not give the mark (ie candidates should only plot the data given)
 - no distinction is made between bar charts and histograms for marking purposes. (For information: bar charts should be used to show discontinuous features, have descriptions on the x axis and have separate columns; histograms should be used to show continuous features; have ranges of numbers on the x axis and have contiguous columns.)
 - where data is read off a graph it is often good practice to allow for acceptable minor error. An answer may be given 7.3 ± 0.1 .
10. **Extended response questions:** if a candidate gives two answers where there is a choice, mark both and give the higher score.
11. **Annotating scripts:**
- put a 0 in the box if no marks awarded – a mark is required in each box
 - indicate on the scripts where marks were given for part of a question worth 3 or 2 marks. A tick near answers will do.
12. **Totalling scripts:** errors in totalling can be more significant than errors in marking:
- enter a total mark for each double page on the bottom corner of the right hand page.
 - add up these double page totals, at least twice, to get an overall total mark.
 - enter this checked total on the front page of the candidate's script.

Part Two: Marking Instructions for each Question

Section A

Question			Expected Answer(s)	Max Mark	Additional Guidance
1			D		
2			B		
3			A		
4			B		
5			C		
6			A		
7			D		
8			A		
9			D		
10			C		
11			C		
12			B		
13			C		
14			A		
15			B		
16			D		

Question			Expected Answer(s)	Max Mark	Additional Guidance
17			D		
18			C		
19			C		
20			A		
21			B		
22			D		
23			D		
24			A		
25			C		
26			D		
27			B		
28			B		
29			A		
30			D		

Section B

Question		Expected Answer(s)	Max Mark	Additional Guidance
1	(a)	Mitosis.	1	
1	(b)	Genes are switched on/expressed/produce proteins / transcribed OR Genes are switched off/not expressed/do not produce proteins.	1	
1	(c)	(i) (Mutation causes) cells do not respond to regulatory signals. 1 mark Cells divide excessively/uncontrolled cell division occurs/cells keep dividing. 1 mark	2	
1	(c)	(ii) Cells break away from the tumour <u>and</u> spread (through the body).	1	
1	(d)	Bone marrow (transplants) OR Skin grafts or description OR Cornea repair OR Any other correct example.	1	Not - Drug trials Not - corneal transplant

Question		Expected Answer(s)	Max Mark	Additional Guidance
2	(a)	Substance – sugar (or named sugar) OR yeast. Reason – (As soon as it is added) the reaction will start. OR So the reaction does not begin (until it is added).	1	Respiration / hydrogen release / colour change are acceptable alternatives for reaction.
2	(b)	Concentration of yeast. Volume / mass of yeast. Concentration of sugar solution. Volume of sugar solution / mass of sugar Concentration of (methylene blue) dye. Volume/number of drops of (methylene) blue dye. Temperature <u>of solutions</u> . Type of yeast. Any 3 for 2 marks, 1 or 2 for 1 mark	2	Not - amount of yeast / sugar / methylene blue. Not – temperature / size of test tube. Not - mass of sugar <u>solution</u> . Not – time / pH.
2	(c)	Repeat the investigation using each sugar solution. OR Repeat the investigation and take an average.	1	
2	(d) (i)	Correct scales and labels on axes. 1 mark Plotting points correctly and drawing lines. 1 mark Labelling/distinguishing the <u>three</u> lines. 1 mark	3	
2	(d) (ii)	Glucose is the best/preferred <u>respiratory</u> substrate (for yeast). OR Glucose can be <u>respired</u> fastest/faster than maltose (and lactose) OR Lactose is not a <u>respiratory</u> substrate (for yeast but the others are).	1	Not - glucose reacts best (with yeast). Not - lactose does not react (with yeast). Must have some reference to respiration in answer
2	(e) (i)	Maltose has to be digested / broken down before yeast could use it (for respiration).	1	Answer must suggest a two stage process – digestion then respiration. Not – bigger molecule/ two glucose molecules take longer to respire.
2	(e) (ii)	The yeast did not contain the enzyme necessary to break down lactose. OR The yeast was unable to digest / break down lactose. OR Lactose does not contain glucose OR Lactose is not broken down to glucose/ respiratory substrates.	1	

Question			Expected Answer(s)	Max Mark	Additional Guidance
3	(a)	(i)	3 :1	1	
3	(a)	(ii)	They sustain <u>contractions</u> /keep <u>contracting</u> for a longer time.	1	Not - Slower contractions.
3	(b)		As the distance of the event increases athletes have more slow twitch muscle fibres <u>and</u> less fast twitch muscle fibres. OR As the distance increases the ratio of slow twitch to fast twitch increases. (or vice versa)	1	More = higher percentage.
3	(c)		Slow twitch have more mitochondria. Slow twitch have a larger blood supply. Slow twitch have a higher concentration of myoglobin. Slow twitch have/store more fat/less glycogen/ less creatine phosphate. Any 2 from 4	2	

Question			Expected Answer(s)	Max Mark	Additional Guidance
4	(a)	(i)	The 3' end of the strand contains deoxyribose/sugar/an OH group <u>and</u> the 5' end contains phosphate.	1	
4	(a)	(ii)	The DNA is <u>heated</u> .	1	If temperature is specified it must be 90°C plus.
4	(a)	(iii)	Primer.	1	
4	(a)	(iv)	Name – (DNA) polymerase. 1 mark Role – Adds / attaches / joins <u>nucleotides</u> . 1 mark	2	Not - RNA polymerase Taq polymerase - correct
4	(b)		Amplification.	1	
4	(c)		Variable numbers of repetitive sequences / tandem repeats OR Repeat sequences of bases / nucleotides	1	

Question			Expected Answer(s)	Max Mark	Additional Guidance
5	(a)	(i)	Individual 3 – $X^{d}Y$ Individual 4 – $X^{D}X^{d}$	1	Must use letter d. Must use superscript. Accept – $X^{d}X^{D}$
5	(a)	(ii)	The allele is carried on the X chromosome <u>and</u> the father/indiv1 passes the Y chromosome to his son. OR The allele is carried on the X chromosome and the father/indiv1 does not pass it to son OR The allele is carried on the X chromosome <u>and</u> the father/indiv1 passes the X chromosome to his daughter.	1	Accept condition / it / gene for allele.
5	(a)	(iii)	50	1	
5	(b)		The <u>sequence</u> / <u>order</u> of amino acids is changed (from that point). OR <u>Different</u> amino acids (in enzyme). 1 mark The <u>shape/active site</u> of the enzyme will change. 1 mark	2	Not – <u>structure</u> of enzyme changes.
5	(c)		250	1	

Question		Expected Answer(s)	Max Mark	Additional Guidance
6	(a)	A – oviduct / fallopian / uterine tube. B – endometrium / endometrial lining.	2	Not – uterus lining
6	(b)	FSH – causes growth/development/ maturation (of follicle). OR (stimulates) release/production of oestrogen. LH – causes development of / maintains (corpus luteum). OR (stimulates) release/production of progesterone.	2	Not – stimulates the follicle Not – ripens follicle
6	(c)	High levels of ovarian hormones/oestrogen/ progesterone. Cause a negative feedback effect on / inhibits the <u>pituitary gland</u> . So concentrations/production of FSH/LH/pituitary hormones fall (so follicles do not develop). Any 2	2	Accept inhibition of FSH / LH (production) as implying fall in concentration. <u>No</u> production of FSH/LH is wrong.
7	(a)	120	1	
7	(b)	Relaxed AND relaxed.	1	
7	(c)	Open – semilunar (valve). Closed – atrioventricular/AV/bicuspid (valve).	1	
7	(d)	<u>Longer time</u> for diastole/between the peaks/ for each stage. OR Peaks further apart. OR <u>Less frequent</u> peaks/systole. OR Cardiac cycle takes <u>more time</u> /is longer.	1	Heart rate / beat would be slower is not sufficient. Trace more spread out/ lengthened is not sufficient.

Question			Expected Answer(s)	Max Mark	Additional Guidance
8	(a)	(i)	13.8 µl/ml	1	Units are essential.
8	(a)	(ii)	96.8	1	
8	(b)		<p>Insulin stimulates the conversion of glucose to <u>glycogen</u> OR less glucose is stored as <u>glycogen</u>. 1 mark</p> <p>This results in glucose being used for respiration/ATP/energy production (in muscle tissue). 1 mark</p>	2	Not – insulin converts glucose to glycogen.
8	(c)	(i)	300	1	
8	(c)	(ii)	29 : 1	1	
8	(c)	(iii)	<p>Volume – increased heart rate /cardiac output / vasodilation (of arterioles/arteries). 1 mark</p> <p>Distribution – vasodilation (of arterioles/arteries in muscles). 1 mark</p>	2	Not - vasodilation in capillaries.

Question			Expected Answer(s)	Max Mark	Additional Guidance
9	(a)	(i)	Tissue fluid.	1	
9	(a)	(ii)	It contains no/little protein.	1	Not - it contains no blood cells.
9	(b)		Interstitial cells – testosterone. Pancreas – insulin/glucagon. Leg muscle (after a sprint) – lactic acid. All 3 for 2 marks, 1 or 2 for 1 mark	2	
9	(c)		To absorb (excess) tissue fluid / liquid X OR To return lymph/tissue fluid / liquid X to the blood system/heart/blood. OR To carry lymph/tissue fluid to the lymph nodes to filter it /destroy bacteria.	1	
10	(a)	(i)	Group 1 – elaboration (of meaning). Group 2 – organisation. Group 3 – rehearsal. 3 for 2 marks, 1 or 2 for 1 mark	2	Not - grouping Not - repetition
10	(a)	(ii)	Contextual cues – same environment/time/ seat/location/people/group of children/ presenter/clothes worn/scent. Explanation – It reminds them when the memory was made / encoded.	1	Not a photo of objects/ pictures on card
10	(b)		Cortex/cerebrum.	1	Cerebral hemisphere is okay.

Question		Expected Answer(s)	Max Mark	Additional Guidance
11	(a)	Changes in mood/activates reward pathway Changes in cognition. Changes in perception. Changes in behaviour/personality Any 2	1	Effects described should either name these categories or be from two of these categories.
11	(b) (i)	They relay impulses /messages /information /signals from neurone(axon) to neurone(dendrite) /muscle/gland. OR They relay impulses/messages/information across the synaptic cleft/synapse.	1	
11	(b) (ii)	1) Stimulate/block neurotransmitter release. 2) Imitate neurotransmitter action (agonists). 3) Block neurotransmitter binding / receptor sites (antagonists). 4) Inhibit neurotransmitter uptake. 5) Inhibit neurotransmitter (enzymatic) degradation/breakdown Any 2 from 5	1	Not – replace neurotransmitters. Not – blocks synapse. Not – damage/destroy receptors.
11	(c)	Explanation – sensitisation is an increase in the number/sensitivity of (neurotransmitter) <u>receptors</u> . 1 mark Cause – drugs that are antagonists/ that block the receptor. 1 mark	2	
11	(d)	People identify with/admire/idolise/look up / to the celebrity/role model. <u>and</u> change their beliefs/behaviour to be like them or to behave/act in a similar manner to the celebrity.	1	An example can be used to help explain this.

Question			Expected Answer(s)	Max Mark	Additional Guidance
12	(a)	(i)	Harmless / dead / attenuated / weakened microbes / pathogens / bacteria / viruses OR Damaged viral DNA <u>and</u> intact protein coat/antigen. OR Adjuvants	1	Not - Disease
12	(a)	(ii)	It allows the <u>quick</u> production of <u>antibodies</u> (against it).	1	
12	(a)	(iii)	Non-vaccinated people are more likely to get the disease / meet an infected person. OR Infected people are more likely to spread the disease / meet a non-vaccinated person. OR This is below the threshold for <u>herd immunity</u> .	1	Not – herd immunity is low.
12	(b)		(The influenza virus shows) <u>antigenic</u> variation. OR Different strains of the influenza virus carry different <u>antigens</u> .	1	Not – antigens mutate.

Question		Expected Answer(s)	Max Mark	Additional Guidance
13	(a)	2	1	
13	(b)	Social Facilitation.	1	Not – audience effect
13	(c)	<p>Repeat the experiment with <u>different</u> individuals who do the task in front of an audience before doing it without an audience.</p> <p>OR</p> <p>One group performs the task with an audience first while another group performs the task without the audience first.</p> <p>OR</p> <p>Two groups of <u>similar</u> ability, one of which does the task with the audience while the other does it without the audience.</p>	1	
13	(d)	Individuals should each repeat it more than once with <u>either</u> the audience or without the audience.	1	

Question		Expected Answer(s)	Max Mark	Additional Guidance
14	(a)	Arteries – vasodilation/increase their diameter 1 mark	2	Accept – widens / dilates / lumen increases
		Capillaries – increases <u>permeability</u> . 1 mark		
14	(b)	Thrombin.	1	
14	(c)	1) They recognise <u>antigens</u> / <u>non-self proteins</u> on the bacteria. 2) They engulf the bacteria or destroy it by phagocytosis. 3) They present antigens on their surface to stimulate the specific immune response. 4) They release <u>cytokines</u> which stimulate the specific immune response / attract more phagocytes. 5) They engulf antigen/antibody complexes (produced by B-lymphocytes). Any 2 from 5	2	Accept pathogen / microbe / foreign cell for bacteria.

Section C

1A

(i) Transcription of DNA

- | | | |
|---|---|---|
| 1 | DNA unzips/hydrogen bonds break/DNA strands separate. | 1 |
| 2 | <u>RNA nucleotides</u> pair with DNA bases. | 1 |
| 3 | Guanine pairs with cytosine, uracil pairs with adenine. (<i>not base letters</i>) | 1 |
| 4 | Sugar phosphate bonds form/sugar phosphate backbone forms. | 1 |
| 5 | This requires ATP/enzymes/RNA polymerase | 1 |
| 6 | Introns/non-coding regions are removed from mRNA/the primary transcript | 1 |

Max 4

(ii) Translation of mRNA

- | | | |
|----|---|---|
| 7 | mRNA attaches/moves to the ribosome. | 1 |
| 8 | tRNA carries amino acid to mRNA /ribosome. | 1 |
| 9 | Each tRNA molecule is attached to a <u>specific</u> amino acid. | 1 |
| 10 | tRNA/mRNA has a anticodon/codon of <u>three bases</u> . | 1 |
| 11 | Anticodon binds to / aligns with codon. | 1 |
| 12 | Order of codons/bases determines the order of amino acids. | 1 |
| 13 | <u>Peptide</u> bonds form between amino acids. | 1 |
| 14 | Ribosome moves along the mRNA strand. | 1 |
| 15 | (Translation/process) begins at a start codon/ends at a stop codon. | 1 |

Max 6

Total 10

1B**(i) The citric acid cycle**

- | | | |
|----|---|---|
| 1 | Pyruvic acid/pyruvate is converted to an acetyl group. | 1 |
| 2 | The acetyl group combines with coenzyme A (to form acetyl coenzyme A) | 1 |
| 2a | <i>Note – Breakdown of pyruvic acid to acetyl coenzyme A gets 1 mark only.</i> | |
| 3 | Acetyl coenzyme A combines with oxaloacetate/oxaloacetic acid to form citrate/citric acid. | 1 |
| 4 | Citrate/citric acid is converted back into oxaloacetate/oxaloacetic acid / 4 carbon compound. | 1 |
| 5 | Carbon dioxide is released. | 1 |
| 6 | (Some) ATP is produced. | 1 |
| 7 | Dehydrogenase (enzymes) remove hydrogen (ions)/(high energy) electrons. | 1 |

Max 5**(ii) The electron transport chain**

- | | | |
|----|---|---|
| 8 | Hydrogen/electrons are passed to (coenzymes) NAD/FAD. | 1 |
| 9 | NADH/FADH ₂ release electrons to the electron transport chain. | 1 |
| 10 | Electrons are passed/cascade along the chain of carriers/proteins. | 1 |
| 11 | Energy is released which pumps hydrogen ions across the (inner) mitochondrial membrane. | 1 |
| 12 | The return flow of hydrogen (ions) synthesises ATP. | 1 |
| 13 | Using the enzyme ATP synthase. | 1 |
| 14 | <u>Oxygen</u> acts as the final electron/hydrogen acceptor / combines with hydrogen. | 1 |
| 15 | Water is formed. | 1 |

Max 5**Total 10**

2A

- | | | |
|----|--|---|
| 1 | Ovulation can be stimulated by drugs. | 1 |
| 2 | These prevent the negative feedback of oestrogen on FSH production. | 1 |
| 3 | Other drugs/hormones (not FSH/LH) can be given which mimic the action of FSH/LH. | 1 |
| 4 | These cause super ovulation/the production of a number of ova/eggs. | 1 |
| 5 | <u>in vitro</u> fertilisation/IVF programmes. | 1 |
| 6 | The eggs are removed (surgically) from the ovaries. | 1 |
| 7 | The eggs are mixed with sperm / fertilisation occurs outside the body. | 1 |
| 8 | Fertilised eggs divide / form a ball of cells / at least 8 cells form / form a blastocyst. | 1 |
| 9 | They are then transferred into the uterus (for implantation). | 1 |
| 10 | <u>Artificial insemination</u> can be used when the man has a low sperm count. | 1 |
| 11 | If man is sterile a donor can supply sperm or several samples can be collected from a man with a low sperm count. | 1 |
| 12 | Intracytoplasmic sperm injection / ICSI can be used if sperm are defective/low in number. | 1 |
| 13 | The <u>head</u> of the sperm is injected directly into the egg. | 1 |

Any 8

The coherence and relevance marks are only awarded when at least five marks have been scored from points 1 to 13 and the following criteria are met.

Relevance – A single short reference to an irrelevant point is not penalised but development of the point is penalised. However, two irrelevant points without development are penalised. For example, mention of two or more of the following will lose this mark:

structure of reproductive organs, menstrual cycle, contraception, ante- and postnatal screening. 1

Coherence – Response should contain paragraphs/subheadings, have a logical sequence and be written in sentences (not bullet points). 1

Total 10

2B

- | | | |
|----|---|---|
| 1 | (Results of) cardiovascular disease include angina/stroke/heart attack/hypertension or high blood pressure/peripheral vascular disease.
Any 2 mentioned | 1 |
| 2 | <u>Atherosclerosis</u> is build-up of cholesterol/calcium/fatty/fibrous material in an artery. | 1 |
| 3 | Low density lipoproteins/LDLs transport cholesterol to the arteries. | 1 |
| 4 | An atheroma/plaque forms beneath the endothelium/lining of artery. | 1 |
| 5 | Artery thickens/hardens/loses elasticity/narrows. | 1 |
| 6 | Blood pressure increases / hypertension develops. | 1 |
| 7 | Atheromas can rupture <u>and</u> clotting factors are released. | 1 |
| 8 | Formation of a clot / thrombus occurs or thrombosis occurs. | 1 |
| 9 | The clot/thrombus can break loose forming an <u>embolus</u> . | 1 |
| 10 | This can block <u>arteries</u> (causing a stroke/heart attack). | 1 |
| 11 | Cells are deprived of oxygen. | 1 |
| 12 | A deep vein thrombosis (can occur) or DVT is a clot in a vein. | 1 |
| 13 | High blood glucose levels/diabetes can cause cardiovascular disease. | 1 |

Any 8

The coherence and relevance marks are only awarded when at least five marks have been scored from points 1 to 13 and the following criteria are met.

Relevance – A single short reference to an irrelevant point is not penalised but development of the point is penalised. However, two irrelevant points without development are penalised. For example, mention of two or more of the following will lose this mark:

structure and function of the heart, cardiac cycle, cardiac conducting system, measuring blood pressure. 1

Coherence – Response should contain paragraphs/subheadings, have a logical sequence and be written in sentences (not bullet points). 1

Total 10

[END OF MARKING INSTRUCTIONS]