2013 Human Biology

Higher (Revised)

Finalised Marking Instructions

GENERAL MARKING ADVICE: HUMAN BIOLOGY

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 CO_2, H_2O
    - 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 $7{\cdot}3 \pm 0{\cdot}1$.

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 why 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:

a. enter a total mark for each double page on the bottom corner of the right hand page.
b. add up these double page totals, at least twice, to get an overall total mark.
c. 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			C		
2			D		
3			D		
4			A		
5			A		
6			B		
7			A		
8			D		
9			A		
10			C		
11			C		
12			D		
13			D		
14			B		
15			C		

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

Section B

Question			Expected Answer/s	Max Mark	Additional Guidance
1	**a**	**i**	pH = 8 temperature = 38	**1**	
1	**a**	**ii**	pH = 6·6 to 8·8 or 2.2 **and** temperature = 20 to 54ºC or 34ºC	**1**	ºC essential at least once
1	**b**		1. The substrate attaches to the active site (on the enzyme). 2. The active site orientates / lines up the molecules. 3. This causes an induced fit/the enzyme to change shape slightly so that the active site fits better. 4. This lowers the activation energy (required for the reaction to occur). 5. Products are released as they have a low affinity for / attraction to the active site. **Any 3 from 5**	**3**	
2	**a**		X = amino acids Y = fats / lipids Z = carbon dioxide / CO_2 ***2 correct = 1 mark***	**2**	
2	**b**		Glycolysis	**1**	Phonetic acceptable e.g. glycolosis, glycolsis, Not acceptable- glycosis
2	**c**		It/acetyl combines with oxaloacetate / oxaloacetic acid to become citric acid /citrate/ tricarboxylic acid.	**1**	It converts to citric acid and then breaks down to oxaloacetate is not sufficient.
2	**d**		When body has used up all carbohydrate and fats/ Y **or** When body has used up all other respiratory substrates. **or** Starvation / anorexia	**1**	Check (a) if Y appears in answer. When body has used up all other energy sources is not acceptable. When malnourished/ undernourished is not correct
2	**e**		Name = glycogen Stored = liver / muscles	**1**	Glucogen is not acceptable

Question			Expected Answer/s	Max Mark	Additional Guidance
3	**a**		41	**1**	
3	**b**		Amplification / (mass) replication / (mass) copying of DNA	**1**	
3	**c**		Separation of the (DNA) strands / breaking hydrogen bonds between strands / denaturing (of the DNA)	**1**	
3	**d**		They bind / anneal / join to (the ends of the) target / complimentary sequences (of DNA being copied).	**1**	
3	**e**		This is closer to the optimum temperature for DNA / taq polymerase.	**1**	
3	**f**	**i**	25 600	**1**	
3	**f**	**ii**	DNA profiling / gel electrophoresis	**1**	Genetic screening / genetic fingerprinting
4	**a**	**i**	H and h ***must be labelled on chromosomes***	**1**	
4	**a**	**ii**	A = X^HY B = X^HX^h / X^hX^H	**1**	If (a)(i) incorrect do not penalise twice
4	**a**	**iii**	0 *and* The only allele she can inherit from her father is dominant / H. **or** The father does not have the recessive allele /h / the condition / the haemophilia **or** The father would have to have haemophilia (for the daughter to get it).	**1**	She can only get the allele from her mother is not sufficient.
4	**b**		Protein – Fibrinogen- ***1 mark*** Description –by thrombin- ***1 mark***	**2**	

Question			Expected Answer/s	Max Mark	Additional Guidance
5	**a**		X = FSH Y = Interstitial cells	**2**	
5	**b**	**i**	Prostate (gland)	**1**	
5	**b**	**ii**	They maintain the <u>mobility / viability</u> of the sperm **or** Specific example- see Additional Guidance.	**1**	<u>Sugar / glucose / fructose</u> provides energy for <u>sperm</u> (to swim) **or** <u>Prostaglandins</u> stimulate contraction of female reproductive tract / system / cervix / uterus **or** <u>Enzymes</u> keep semen / fluid that the sperm swim in at the correct viscosity / thickness
5	**c**		Germline cells = 100 Mature sperm cells = 50	**1**	
6	**a**		1. It contains more / higher concentrations/ levels/ of IgA/ antibodies <u>and</u> 2. It contains less / lower concentrations/ levels/ of lactose.	**1**	Answer must give a comparison eg high IgA concentration is incorrect. The use of volume of IgA/lactose is incorrect.
6	**b**		460 <u>ml</u> ***units essential***	**1**	
6	**c**	**i**	The <u>volume</u> of the milk produced increased.	**1**	
6	**c**	**ii**	1 : 30	**1**	
6	**d**		39.9	**1**	
7	**a**		X = artery / arteriole Y = capillary	**1**	

Question			Expected Answer/s	Max Mark	Additional Guidance
7	**b**		oxygen, glucose, amino acids, fatty acids, glycerol, vitamins, minerals **any 2**	**1**	
7	**c**		The muscle cells / muscles started respiring anaerobically / without oxygen.	**1**	
7	**d**		By the lymphatic system / lymphatic vessels / lymphatic capillaries / lymph.	**1**	Lymph nodes are incorrect.

Question			Expected Answer/s	Max Mark	Additional Guidance
8	**a**		0.3	**1**	
8	**b**	**i**	75	**1**	
8	**b**	**ii**	5250 ***NB – if answer to b(i) is incorrect check if 70 x b(i) = b(ii) and if it does mark it correct.***	**1**	If 48 is in (b)(i) the correct answer is 3360. If 120 is in (b)(i) the correct answer 8400. If 200 is in (b)(i) the correct answer 14 000.
8	**c**		1. (Increase is) controlled by the medulla / autonomic nervous system. 2. Sympathetic nervous system affects the SAN / pacemaker 3. Adrenaline / epinephrine increases heart rate.	**3**	
9	**a**	**i**	Height and weight / mass	**1**	
9	**a**	**ii**	30	**1**	
9	**b**		No (metabolic) energy is required for their digestion.	**1**	
9	**c**		Increased energy expenditure **or** Preserves lean tissue / muscle tissue **or** Keeps fat content of body low / reduces fat content of body	**1**	
9	**d**		1. Keeps weight / fat / cholesterol under control 2. Minimises stress 3. Lowers hypertension / high blood pressure 4. Improves HDL levels / reduces LDL levels in the blood / improves HDL:LDL ratios **any 2**	**1**	

Question			Expected Answer/s	Max Mark	Additional Guidance
10	**a**		Arrow correctly drawn / going from left to right.	**1**	Arrow going along a dendrite into the cell body is correct.
10	**b**		DNA / gene / nucleus codes for <u>neurotransmitter</u> / enzyme which makes/breaks down the <u>neurotransmitter</u>. **or** DNA / gene/ nucleus codes for <u>receptors</u>	**1**	Nucleus stores information for neurotransmitter production is correct. Nucleus controls the release of neurotransmitter is incorrect.
10	**c**		Mitochondrion / mitochondria <u>and</u> Stores / contains / carries / releases / provides <u>neurotransmitter / acetylcholine / noradrenaline</u>.	**1**	
10	**d**	**i**	Has less / no myelin (sheath) **or** Has fewer / less dendrites / synaptic knobs	**1**	
10	**d**	**ii**	Slower <u>impulses</u> / fewer <u>impulses</u> reach the synaptic cleft **or** <u>Threshold</u> less likely to be reached / less <u>neurotransmitters</u> released into the synaptic cleft **or** Fewer connections to other nerve cells.	**1**	Slower signals acceptable. Slower messages incorrect.
11	**a**		Corpus callosum	**1**	
11	**b**	**i**	1. The word key / information from left eye went to the right (cerebral) hemisphere. 2. The right hemisphere controls / moves the left hand (so key is picked up). 3. The word spoon / information from right eye went to the left hemisphere. 4. Information cannot be transferred to the right hemisphere / from left hemisphere. (so spoon is not picked up) **All four points needed for two marks.** **Two or three points needed for one mark.**	**2**	Insert appropriate number where point given is correct. **Only penalise 'side of brain' once.** Information cannot be transferred between the hemispheres is not sufficient.

Question			Expected Answer/s	Max Mark	Additional Guidance
11	**b**	**ii**	Prediction – Spoon	**1**	
			Reason – Information <u>from the right eye</u> goes to the left (cerebral) hemisphere / side of the brain which controls language production / speech.	**1**	There are three parts to this answer- source, destination and function.

Question			Expected Answer/s	Max Mark	Additional Guidance
12	**a**		Correct scales and labels on both axes ***1 mark*** Points correctly plotted and line drawn ***1 mark***	**2**	Remove one mark for bar graph. Remove one mark for using less than half of the graph paper. Remove one mark for axes wrong way around.
12	**b**		85	**1**	
12	**c**		1. Similar age 2. Same gender / sex (ratio) 3. Same memory span / mental ability / IQ of students 4. Same order of words 5. Same words / list used 6. Words read out in similar manner- eg rate / tone / time 7. Procedure carried out in same place / environment / at same time of day 8. Students given the same time to write down words remembered. **any 3 for 2 marks, 2 for 1 mark**	**2**	**Not acceptable:** Same distraction tasks. Same length of words. Same number / amount of words in list. Same temperature.
12	**d**	**i**	(The students in the control group) would not be given the distraction task. **or** The students were allowed to start writing immediately after the list was read out.	**1**	
12	**d**	**ii**	The words towards the end of the list would show higher recall.	**1**	
12	**e**		It prevented students rehearsing the list of words and keeping them in short term memory / transferring them to long term memory. **or** It displaced words from the list that were held in short-term memory.	**1**	

Question			Expected Answer/s	Max Mark	Additional Guidance
13	**a**		It results in a motor pathway / motor memory / neural pathway / neural circuit / procedural memory being established.	**1**	
13	**b**		Approximate / improved / good behaviour is rewarded / reinforced / praised. ***1 mark*** Only successive / over time improvements are rewarded / reinforced / praised. ***1 mark***	**2**	
13	**c**	**i**	Generalisation	**1**	
13	**c**	**ii**	She is persuaded / convinced (by friends / the media / relatives / others.)	**1**	Influenced by others is incorrect as this could be identification.
13	**d**		Name – deindividuation Cause – Loss of personal identity / personality / sense of individuality. **or** Gain of anonymity / 'facelessness'.	**1** **1**	Deindividualisation is incorrect. Take on group identity is not sufficient. They think that they are less likely to get caught is incorrect. They want to feel part of a group/ peer pressure is incorrect.
14	**a**	**i**	to prevent multiplication / reproduction / replication / of the virus / pathogen / nucleic acid **or** to inactivate / weaken the virus / pathogen **or** to prevent individuals getting the disease (symptoms)/ ill / infected	**1**	
14	**a**	**ii**	to allow recognition by the immune system / lymphocytes **or** so antibodies / memory cells can be produced	**1**	To allow recognition by the body is not sufficient. Antigens remembered by immune system is not correct. Antibodies binding to antigens is incorrect.

Question			Expected Answer/s	Max Mark	Additional Guidance
14	**b**		Different strains of flu / the viruses have different antigens / surface proteins / antigenic markers / show antigenic variation.	**1**	Antibodies are specific to antigens is not sufficient.
14	**c**		1. Destroys infected cells by apoptosis / production of self-destructive enzymes / inducing suicide. 2. Secrete cytokines that activate / attract B lymphocytes / phagocytes.	**2**	
14	**d**		It is down to chance which group subjects are placed in / or description of randomised method of allocation to groups eg picking names out of hat. ***1 mark*** One group receives the vaccine / drug while the other group gets a harmless liquid / dummy drug / the placebo. ***1 mark***	**2**	

Section C

1A Give an account of cell differentiation under the following headings:

(i) Stem cells

1 Differentiation occurs when unspecialised cells become specialised (to perform a specific function)

2 Stem cells are unspecialised cells that can (divide to) form more stem cells

3 Embryonic stem cells can differentiate / develop into all / any cell types

4 Tissue / adult stem cells give rise to a more limited range of / fewer cell types

5 Example given such as stem cells in the (red) bone marrow only produce blood cells / named blood cells

6 A differentiated cell only has a few genes switched on / produces specific proteins.

4 marks

(ii) Somatic cells

7 Somatic cells form different types of body tissue

8 One example of a somatic cell **and** the tissue formed from it

9 Two **more** examples of somatic cells **or** two more of the tissues formed
Examples include –
a. epithelial cells form lining tissue of body cavities / surface
b. blood/bone/cartilage cells forming connective tissue
c. muscle cells forming muscle tissue
d. nerve cells forming nervous tissue

10 Body organs are formed from a variety/mixture of these tissues

11 (The nucleus of a) somatic cell divides by mitosis (to maintain the diploid chromosome number)

4 marks

(iii) Germline cells

12 The (nucleus of a) germline cell can divide by mitosis to produce more germline cells / diploid cells

13 (The nucleus of a) germline cell can divide by meiosis to produce haploid gametes/ cells.

14 Mutations in germline cells can be passed on to offspring (whereas mutations in somatic cells are not).

2 marks

Total 10

1B Give an account of skeletal muscle cells under the following headings:

(i) Lactic acid metabolism

1 During exercise (muscles) do not generate enough oxygen for (aerobic) respiration / the electron transport chain.

2 Pyruvate / pyruvic acid is converted to lactic acid

3 This involves the transfer of hydrogen from NADH (produced during glycolysis)

4 This regenerates the NAD needed to maintain ATP production by glycolysis

5 Lactic acid builds up (in muscles) causing fatigue/ an oxygen debt

6 (When exercise stops) lactic acid is converted back into pyruvate/pyruvic acid / glucose (in the liver)

4 marks

(ii) Slow twitch muscle fibres

7 Contract slowly but maintain contractions for a long time

8 They rely on aerobic respiration (to generate ATP)

9 They have many mitochondria / a large blood supply / a high concentration of myoglobin

10 Their (main) storage fuel/ energy source is fats.

3 marks

(iii) Fast twitch muscle fibres

11 Contract quickly but cannot maintain contractions for a long time

12 They generate ATP through glycolysis

13 They have few mitochondria and a low blood supply

14 Their (main) storage fuels / energy sources are glycogen and creatine phosphate.

15 Examples given of appropriate activities which use slow twitch and fast twitch muscle fibres, eg long-distance running, cycling and cross-country skiing for slow twitch and sprinting or weightlifting for fast twitch.
Allocate in either section (ii) or (iii)

3 marks

Total 10

2A Describe how recreational drugs can affect the brain

1 Many affect (neurotransmission in) the reward circuit of the brain

2 They alter mood / cognition/ perception/ behaviour (any **two**)

3 They may stimulate the release of neurotransmitters

4 They may act as agonists or antagonists (**both**)

5 Agonists imitate the actions of neurotransmitters

6 Antagonists prevent the binding of neurotransmitters / bind to receptors

6a *Awarded if agonists and antagonists not named but both functions given correctly.*

7 Drugs may inhibit the reuptake / enzyme degradation of neurotransmitters (at a synapse)

8 Sensitisation may occur with an increase in the number/sensitivity of receptors

9 Antagonists cause sensitisation leading to addiction

10 Desensitisation may occur with a decrease in the number/sensitivity of receptors

11 Agonists cause desensitisation leading to drug tolerance

12 Any suitable example of a drug and how it affects the brain
Examples could include –
a. Cocaine blocking dopamine reuptake (channels)
b. Cannabis binding to (cannaboid) receptors
c. Ecstasy / MDMA stimulating serotonin levels
d. Alcohol binding to (GABA) receptors, increasing dopamine / serotonin / epinephrine levels
e. Nicotine activating receptors, increasing dopamine / serotonin / epinephrine levels

8 marks

The coherence and relevance marks are only awarded when at least five marks have been scored from points 1 to 12 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. **1 mark**
For example, mention of two or more of the following will lose this mark:

Divisions of nervous system, parts of brain, short and long-term memory, neurone structure, neural pathways

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

After candidate response write an R and a C and place a tick or cross beside each before totalling the marks for the question.

Total 10

2B Describe non-specific defences that the body uses to protect itself from pathogens

1 The skin prevents the entry of pathogens / is a physical barrier.

2 Epithelial cells (in cavity linings) produce (protective chemical) secretions

3 Description of **one** non-specific defence e.g. mucus in windpipe / acid in stomach / lysozyme or anti-bacterial substances in tears / coughing or sneezing / blood clotting

4 The inflammatory response is caused by the release of histamine from mast cells

5 Vasodilation / increased capillary permeability / increased blood flow (occurs)

6 Increased blood flow / secretion of cytokines results in the accumulation of phagocytes

7 It also results in the delivery of antimicrobial proteins / clotting elements to the site

8 Phagocytes recognise surface antigens/ protein markers on pathogens

9 They then destroy the pathogen by engulfing it / by phagocytosis

10 Natural killer (NK) cells induce the pathogen to destroy itself / apoptosis

11 (The NK cells cause) the pathogen to produce digestive / self-destructive enzymes

12 Phagocytes / NK cells release cytokines that stimulates the (specific) immune response

8 marks

The coherence and relevance marks are only awarded when at least five marks have been scored from points 1 to 12 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: **1 mark**

Any specific cellular defence, T and B lymphocytes, memory cells, allergies, autoimmune responses.

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

After candidate response in the paper write an R and a C and place a tick or cross beside each before totalling the marks for the question.

Total 10

[END OF MARKING INSTRUCTIONS]