2012 Human Biology

Higher

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:

- 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.

2012 Human Biology Higher

Marking scheme

Section A

1.	D	16.	C
2.	C	17.	B
3.	D	18.	B
4.	B	19.	A
5.	C	20.	B
6.	A	21.	B
7.	C	22.	C
8.	A	23.	A
9.	C	24.	D
10.	A	25.	D
11.	D	26.	D
12.	A	27.	C
13.	A	28.	B
14.	B	29.	D
15.	D	30.	B

<table>
<tr><th colspan="2">Question</th><th>Acceptable Answer</th><th>Mark</th><th>Unacceptable Answer</th><th>Negates</th></tr>
<tr><td>1. (a)</td><td>(i)</td><td>Movement of molecules/substances/ions against a concentration gradient/from low to high concentration/using energy/using ATP</td><td>1</td><td>Along a concentration gradient
Movement of proteins</td><td></td></tr>
<tr><td></td><td>(ii)</td><td>Contains large numbers of /many mitochondria
OR
Mitochondria provide energy/ATP</td><td>1</td><td>Contains mitochondria</td><td></td></tr>
<tr><td></td><td>(iii)</td><td>Folded/convoluted membrane/surface/microvilli provides a large/greater/increased/high surface area</td><td>1</td><td></td><td>wall
Villi
Lining</td></tr>
<tr><td>(b)</td><td></td><td>Proteins / protein pump / carrier protein</td><td>1</td><td>Structural/porous proteins
Carrier molecules
Protein channel</td><td></td></tr>
<tr><td>(c)</td><td>(i)</td><td><table><tr><th>region</th><th>name</th><th>respiration stage</th></tr><tr><td>X</td><td>matrix</td><td>Krebs/citric/tricarboxylic acid cycle</td></tr><tr><td>Y</td><td>cristae</td><td>Cytochrome system/oxidative phosphorylation/hydrogen or electron transfer system</td></tr></table>Any 2 or 3 answers correct = 1 mark,
4 answers correct = 2 marks
If X and Y are reversed but name and stage correct give 1 mark</td><td>2</td><td>Hydrogen transport system</td><td></td></tr>
<tr><td></td><td>(ii)</td><td>Structure Difference – Mitochondrion would contain fewer folds/cristae/invaginations/convolutions

Reason – Less respiration/ATP/energy is required</td><td>1</td><td>Fewer stalked particles
Smaller surface area
Smaller cristae
Cell carrying out less work</td><td></td></tr>
</table>

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
2. (a)	Humoral (response)	**1**		
(b) (i)	B-lymphocyte / plasma cell	**1**	Lymphocyte B cell	
(ii)	Attaches/recognises/identifies/detects the (polio) virus (Divides to) produce cell Q/ lymphocytes/plasma cells (Divides to) produce memory cells *(Any 2)*	**1**	Trap virus Identifies pathogen	Destroys Attraction
(c)	To respond quickly to another/a second invasion of a virus/bacterium/pathogen/toxin/antigen	**1**	Disease	
(d)	The measles virus carries different antigens (to the polio virus) **OR** Antibodies are specific to one virus / polio /antigen **OR** The receptor on cell P/the B-lymphocyte/the memory cell does not match the measles virus antigen	**1**	Vaccine is specific Antibodies are specific (on own)	
(e) (i)	Artificial passive (immunity)	**1**	Passive	
(ii)	Advantage – provides instant/rapid immunity/protection – *1 mark* Disadvantage – immunity/protection does not last for a long time/ is short-lived/is temporary **or** Memory cells/antibodies are not produced (by body) – *1 mark*	**2**	Allows body time to make antibodies Fast response (on own) Allergies / react against Immunity is not active	

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
3. (a) (i)	R = X^DX^d **or** X^dX^D and S = X^DY (accept YX^D)	**1**		
(ii)	33 / 33·3 / 33⅓	**1**		
(iii)	Son of T = 0 and Son of U = 50	**1**		
(b) (i)	Mutation	**1**	Inborn error of metabolism	
(ii)	Alter/change the sequence/order of bases /nucleotide **OR** A specific base / nucleotide change is described (insertion, deletion, inversion, substitution described)	**1**	Bases are changed	Codon
(iii)	The protein produced contains an altered sequence/order of amino acids **OR** The protein produced contains a different amino acid / is missing an amino acid / has an extra amino acid	**1**	The genetic code does not produce the correct protein	
(c)	Genetic screening/genetic counselling	**1**		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
4. (a) (i)	Trypsin / the enzyme digests/breaks down gelatine/protein <u>and</u> releases the (dark) chemicals	**1**	Trypsin digests the colour	
(ii)	Temperature <u>of solution/trypsin</u> pH Volume/depth of solution/trypsin Size/length/area of film Age/type/thickness of film/thickness of gelatin Age of trypsin *(Any 2)*	**2**	Temperature of room/test-tube Test-tube dimensions Mass of film Volume of gelatine Source of trypsin	Amount
(iii)	Repeat the procedure <u>at each concentration</u> (and then calculate an average)	**1**	Repeat the investigation Repeat with different solutions	
(iv)	Axes correctly drawn and labelled – *1 mark* *Must have trypsin concentration (%)* ***and*** *time film to clear (s)* Points correctly plotted and line drawn – *1 mark*	**2**	Remove one mark for bar graph **OR** for not using more than half of the graph paper	
(v)	There is <u>more</u> trypsin/enzyme (molecules)/active sites to react with the gelatine/substrate/protein	**1**		
(vi)	Surface area of film/size of film/thickness of gelatine is limiting the rate of reaction **OR** The size of the film/gelatine is too small to allow all enzyme molecules to react with it **OR** The reaction requires a minimum time to occur	**1**	Enzyme is no longer limiting the reaction Substrate conc limiting reaction Enzyme breaking down gelatine as fast as it can Other factors are limiting the reaction	
(b) (i)	The small intestine/duodenum/ileum	**1**		
(ii)	So that they do not digest the cells / organs /pancreas/ glands / tissues <u>that produce them</u>	**1**		
(iii)	Vitamins/minerals/hydrochloric or stomach acid	**1**	Acid on own	

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
5. (a) (i)	X = SAN/SA Node/sino-atrial node / pacemaker Y = AVN/AV node/atrio-ventrivular node	**1**		
(ii)	The atria contract / atrial systole	**1**		
(iii)	Arrows must travel <u>down</u> the central wall of the heart from Y and <u>up each</u> side of the ventricles	**1**		If arrows continue up into wall of atria
(b) (i)	Bicuspid / AV / atrio-ventricular / mitral	**1**		Right AV valve
(ii)	Ventricular systole	**1**		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
6. (a)	Progesterone	**1**		
(b) (i)	(Causes the) repair/thickening/proliferation of the endometrium/lining	**1**	Wall / inner layer	
(ii)	Stimulates/causes LH/FSH release / production	**1**	Stimulate LH/FSH LH/FSH release	Inhibits LH/FSH
(c)	Progesterone/hormone X remains high/constant/ does not decrease **OR** Oestrogen remains high/does not decrease during the second half of the cycle/after day 24/25	**1**	Progesterone production increases	
(d) (i)	P – Graafian follicle Q – Corpus luteum	**1**		
(ii)	Ovulation / release of egg from ovary **OR** surge in LH concentration (OSO)	**1**		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
7. (a)	Breathing rate remains constant <u>and</u> volume of each breath increases – *1 mark* <u>Correct figures and units</u> quoted for at least <u>one</u> change, eg breathing rate remains constant at 14 breaths/min **OR** volume of each breath increases from 480 to 1240 cm^3 *– 1 mark*	**2**		
(b)	18	**1**		
(c)	14 000	**1**		
(d) (i)	1800 to 1840 <u>cm^3</u> (**units essential**)	**1**		
(ii)	Lung volume is nearing its maximum capacity **or** He is breathing as deeply as possible **or** Lungs have a limited capacity / can only hold so much air	**1**	Breathing rate too fast to take deep breaths Lungs cannot inhale any more	
(e)	(Carbon dioxide is produced) by <u>respiration</u> / <u>the Krebs Cycle</u> (in body cells)	**1**		anaerobic

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
8. (a)	Three arrows drawn – all pointing in the correct direction, ie: hepatic artery into the liver hepatic portal vein into the liver hepatic vein out of the liver	**1**		Arrow drawn on bile duct
(b) (i)	Bile	**1**	Bile salts	
(ii)	Function – Emulsification of lipids/fats **OR** Emulsification correctly described – breakdown of large fat pieces into fat droplets Explanation – This allows enzyme/lipase to speed up the breakdown (of lipids) **OR** This increases the surface area (of lipids) for enzyme/lipase **OR** Function – Neutralisation of stomach acid **OR** raises pH of intestine Explanation – This provides the optimum pH for lipase/ enzymes	**2**	Digestion instead of emulsification	Breakdown of fat molecules
(c)	Glycogen/Iron/Vitamins (A or D)	**1**	Glycogen wrongly spelt	

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
9. (a)	(The cerebrum) has a convoluted/folded surface/large surface – *1 mark* This allows for an increased number of cell bodies/ cells/neurones – *1 mark*	**2**	 Increased interconnections	
(b)	Transfers/shares information/impulses <u>between</u> the two (cerebral) hemispheres/sides of the brain	**1**	Connects the two sides of the cerebrum So brain acts as an integrated whole Transfers messages	
(c) (i)	The autonomic (nervous system)	**1**		Peripheral
(ii)	Sympathetic speeds it up <u>and</u> parasympathetic slows it down	**1**		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
10. (a)	51 <u>weeks</u> (unit essential)	**1**		
(b)	3, 4, 5 and 6	**1**		
(c)	Genes/inheritance Encouragement/attachment Diet Environment One has had an accident One has had a disease/has a muscular disease One has a slower myelination rate One has a (physical) disability One had a premature birth *Any other acceptable answers* *(Any 2)*	**1**	Learning Poor appetite Myelination has not occurred One is a slow developer One has a slow rate of maturation	
(d) (i)	Maturation	**1**		
(ii)	Myelination/development of myelin sheath (around nerve fibres)	**1**		

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
11. (a)	Use people of similar age/gender or gender balance/memory ability or span/use the same number of people / same first language *(Any 2)*	**1**	Same intelligence / IQ Same book Random allocation Same environmental conditions/occupation	
(b)	Short-term memory/STM holds on average seven / 5-9 words/items **or** capacity/span of STM **OR** Short-term memory/STM can retain words for 30 seconds/a short time **or** duration of STM	**1**	Words are still in STM / recency effect	
(c)	To prevent rehearsal of the words **OR** To displace / remove the words from short-term memory	**1**	To prove the words are in LTM Displace into LTM	
(d)	1. The meaning of words has no effect on their recall/retrieval from short-term memory 2. Related (meaning) words are harder to recall/retrieve from long-term memory (than unrelated words) **OR** Unrelated (meaning) words are easier to recall/retrieve from long-term memory (than related words)	**2**	Answers that relate to storage or encoding. Answer must not simply restate the results. Remember instead of recall	

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
12. (a) (i)	During Stage 2 it decreases <u>and</u> during Stage 3 it remains constant/steady /level	**1**		
(ii)	Rapid increase because <u>death rate</u> <u>drops quicker</u> than the <u>birth rate</u>– *1 mark* It levels off because <u>birth</u> and <u>death rate</u> become similar/equal – *1 mark*	**2**	The birth rate is much higher than the death rate in Stage 2	
(iii)	Increased/improved/better food supply/diet/agriculture Increased/improved/better medical provision/vaccination/health care Improved sanitation/hygiene/provision of clean drinking water *(Any 2 for 1 mark)*	**1**	Improved housing Improved living conditions	
(b) (i)	Pesticides remove (many) organisms/reduce species diversity/reduce biodiversity **or** Removal of pests/animals removes food sources for other species/organisms (further up the food chain) **or** Pesticides accumulate/build up along the food chain killing species/animals at the top of the food chain.	**1**		
(ii)	Selective breeding/genetic modification/genetic engineering/genetic manipulation/somatic fusion/crop rotation /irrigation/ mechanisation/ monoculture/ deforestation to <u>create agricultural land</u>/ development of marginal land/ terracing / intensive farming	**1**	GM Provide more agricultural land Manure	

Question	Acceptable Answer	Mark	Unacceptable Answer	Negates
(c) (i)	A large/exponential increase/rapid growth/large amount of algae	**1**		
(ii)	1. Decomposition/decay (of dead algae by bacteria) 2. Increase in numbers of bacteria 3. Removal/decrease of oxygen (in the water) 4. Death of other species/fish/invertebrates/animals 5. Shading effect of algae leads to death of other plants 6. Toxic algae endangers other animals/man *Any four points for 2 marks,* *Two or three points for 1 mark*	**2**	Change in acidity	

Section C

1A Give an account of the carbon cycle under the following headings:

(i) natural uptake and release of carbon **4**

1. (Carbon exists as) carbon dioxide in the atmosphere/air/water
2. Photosynthesis (by plants) takes up CO_2
3. Animals gain carbon by eating
4. CO_2 is released as a result of respiration (by living organisms)
5. Decomposition / decay / breakdown by microbes/bacteria releases methane/CO_2
6. (Some organisms take up) carbon becomes fossilised/forms fossil fuels/coal/oil/natural gas

(ii) disruption of the carbon cycle by human activities **6**

7. Burning/use of fuels releases carbon/ CO_2 (in the air)
8. Increased population has increased fossil fuel use
9. Industrialisation/transport uses (increased) fossil fuels/releases CO_2
10. Deforestation reduces photosynthesis/reduces CO_2 uptake
11. Increase in CO_2 in air causes global warming/greenhouse effect
12. Methane (CH_4) also causes global warming/is a greenhouse gas
13. Methane production caused by (increased) livestock farming/rice production
14. Domestic waste production/landfill creates methane

1B Give an account of the nervous system under the following headings:

(i) the role of neurotransmitters at the synapse **6**

1. The synapse/synaptic cleft is the junction/gap between neurones/nerve cells*
2. Neurotransmitters are stored in /released from vesicles*
3. Neurotransmitters are released on arrival of impulse
4. Neurotransmitters diffuse across the gap
5. Neurotransmitters bind with/reach receptors*
6. A threshold/minimum number of neurotransmitters is needed (for the impulse to continue)
7. Noradrenaline is removed by reabsorption
8. Acetylcholine is broken down by enzymes / acetylcholinesterase
   Only award points 9 or 10 if neither of points 7 and 8 have been awarded
9. *Both noradrenaline and acetylcholine named but no/wrong description of their removal given*
10. *Both forms of neurotransmitter removal given but no/wrong mention of noradrenaline and acetylcholine*

(ii) converging and diverging neural pathways **4**

11. A converging pathway has several neurones linking to one neurone (if diagram must show direction of impulse)*
12. This increases the neurotransmitter concentration/chances of impulse generation
13. Any example of a converging pathway, eg rods of retina
14. A diverging pathway has one neurone linking to several neurones (if diagram must show direction of impulse)*
15. This means that impulses are sent to several destinations at the same time
16. Any example of a diverging pathway, eg fine motor control in fingers or release of sweat from sweat glands

* Can be given on **labelled** diagram

2A Describe the exchange of substances between plasma and body cells. 10

1. Plasma is the liquid part of the blood
2. *(Any three)* named dissolved substances carried – oxygen, carbon dioxide, glucose, amino acids, urea, vitamins, minerals, etc
3. Capillaries have a large surface area/thin walls
4. High pressure (at the arterial end of the capillaries) forces fluid/plasma out
5. Tissue fluid (bathes the cells)
6. Plasma proteins/blood cells do not pass through capillary walls/stay in blood
7. (Dissolved) substances diffuse/move from tissue fluid into body cells
8. Waste products/named example diffuse/move out of the cells
9. Low pressure (at the venous end of the capillary network) allows return of fluid
10. Liquid/water also returns by osmosis (into the plasma)
11. (Excess) tissue fluid enters lymph vessels/lymph
12. This lymph/fluid is carried back to the blood (by lymphatic system)

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:
A description of arteries or veins, a description of the heart, the cardiac cycle. **1 mark**

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

Note – After the 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.

2B Describe involuntary mechanisms of temperature control. 10

1. Hypothalamus detects/controls body temperature
2. (Thermo) receptors in the skin/body detect temperature
3. Temperature is maintained by negative feedback (mechanisms)
4. (Increased) sweating results in heat loss by evaporation
5. Increased blood flow to skin/vasodilation causes increased heat loss **or** reduced blood flow to skin/vasoconstriction reduces heat loss
6. Arterioles (not capillaries) constrict / dilate
7. Contraction of hair muscles / erector pili makes hair stand up
8. This traps a layer of air which insulates /reduces heat loss
9. Increased metabolic rate causes heat production **or vice versa**
10. Adrenaline/thyroxine release occurs (when body is cold)
11. Shivering increases/causes heat production by muscles
12. Mechanisms are impaired in older people/undeveloped in infants

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:
A description of any voluntary mechanisms, a description of hypothermia. **1 mark**

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

Note – After the 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.

[END OF MARKING INSTRUCTIONS]