



# **2013 Human Biology**

## **Higher**

### **Finalised Marking Instructions**

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## 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<sub>2</sub>, H<sub>2</sub>O
  - 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  $7.3 \pm 0.1$ .

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.

## 2013 Human Biology Higher

### Marking scheme

#### Section A

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

**Marking instructions**

**2013 Human Biology**

**Section B**

Question	Expected Answers	Max Mark	Additional Guidance
<p>1. (a) (i)</p> <p>(ii)</p> <p>(iii)</p>	<p>pH = 8 temperature = 38</p> <p>pH = 6.6 to 8.8    <b>or</b>                    2.2            <b>and</b> temperature =20 to 54°C            <b>or</b>    34°C</p> <p>High <u>temperatures</u> denature the enzyme / protein    <b>or</b> High <u>temperatures</u> break (hydrogen) bonds.                    <b>1 mark</b></p> <p>The <u>active site</u> is changed / denatured The substrate no longer fits into the <u>active site</u>                    <b>1 mark</b></p>	<p>1</p> <p>1</p> <p>2</p>	<p>°C essential at least once</p> <p>Above 38 °C, above optimum temperature, increasing temperature are all acceptable</p>
<p>(b) (i)</p> <p>(ii)</p>	<p>(enzyme) activator / activation / activates</p> <p>Trypsin would digest / break down pancreas <u>cells/tissues</u> / <u>cells/tissues</u> that produce it or surround it / <u>cell</u> proteins. <b>or</b> Trypsinogen will not digest /break down pancreas <u>cells</u> / <u>cells/tissues</u> that produce it or surround it / <u>cell</u> proteins.</p>	<p>1</p> <p>1</p>	<p>Digest pancreas/glands that made it is unacceptable</p> <p>Damage / destroy pancreas cells is unacceptable</p>

Question	Expected Answers	Max Mark	Additional Guidance
2. (a)	X = amino acids Y = fatty acids Z = carbon dioxide  <i>2 correct = 1 mark</i>	2	
(b)	Glycolysis	1	Phonetic acceptable e.g. glycolosis, glycolsis, Not acceptable – glycosis.
(c)	It / acetyl <u>combines</u> with a 4 carbon compound / intermediate compound /oxaloacetic acid <u>and</u> becomes citric acid / tricarboxylic acid.	1	It converts to citric acid and then <u>breaks down</u> to a 4 carbon molecule is not sufficient.
(d)	Starvation / anorexia <b>or</b> When body has used up all carbohydrates <u>and</u> fats.	1	When body has used up all other energy sources is not acceptable.
(e)	Name = glycogen Stored = liver / muscles	1	Glucogen is not acceptable.

Question	Expected Answers	Max Mark	Additional Guidance
3. (a) (i)	to prevent multiplication / reproduction / replication of the <u>virus</u> – <b>1 mark</b>	<b>2</b>	To prevent replication of nucleic acid is not sufficient
(ii)	to allow recognition by the immune system / lymphocytes <b>or</b> so antibodies / memory cells can be produced – <b>1 mark</b>		To allow recognition by the body is not sufficient
(b)	X is active and natural <b>1 mark</b> Y is active and artificial <b>1 mark</b>	<b>2</b>	
(c)	Different strains of flu / the viruses have <u>different</u> antigens / surface proteins / antigenic markers	<b>1</b>	Antibodies are specific to antigens is not sufficient
(d)	Attach / bind to <u>infected cells</u> and destroy them.	<b>1</b>	Destroy the virus is wrong. They use the cell mediated response is not acceptable.

Question	Expected Answers	Max Mark	Additional Guidance
4. (a) (i) (ii) (iii)	H and h <b>must both be labelled on chromosomes</b> A = X <sup>H</sup> Y      B = X <sup>H</sup> X <sup>h</sup> / X <sup>h</sup> X <sup>H</sup> 0 <u>and</u> The only allele she can inherit from her <u>father</u> is dominant / H <b>or</b> The <u>father</u> does not have the recessive allele / h / the condition / the haemophilia <b>or</b> The <u>father</u> would have to have haemophilia (for the daughter to get it).	1 1 1	If (a)(i) incorrect do not penalise twice  She can only get the allele from her mother is not sufficient.
(b) (i)  (ii)	Their length / size <b>or</b> The position of the centromere <b>or</b> Banding pattern (after staining)  Non-disjunction	1  1	Shape is not correct Position of gene is not sufficient.



Question	Expected Answers	Max Mark	Additional Guidance
5. (a)	X = FSH Y = Interstitial cells	2	
(b) (i)	Prostate (gland) <b>or</b> seminal vesicle	1	Nutrients not sufficient.  Maximum viscosity is incorrect
(ii)	<u>Sugar / glucose / fructose</u> provides energy for <u>sperm</u> (to swim) <b>or</b> <u>Prostaglandins</u> stimulate contraction of female reproductive tract / system / cervix / uterus <b>or</b> <u>Enzymes</u> keep semen / fluid that the sperm swim in at the correct viscosity / thickness	1	
(c)	Sperm mother cells = 100 Mature sperm cells = 50	1	

Question	Expected Answers	Max Mark	Additional Guidance
6. (a) (i)	Colostrum	1	Answer must give a comparison e.g high IgA concentration is incorrect. The use of volume of IgA/lactose is incorrect.
(ii)	1. It contains more/higher concentrations / levels / amounts of IgA / antibodies. <u>and</u> 2. It contains less / lower concentrations / levels / amounts of lactose.	1	
(b)	460 <u>ml</u> <b><i>units essential</i></b>	1	
(c) (i)	The <u>volume</u> of the milk produced increased	1	
(ii)	1 : 30	1	
(d)	39.9	1	

Question	Expected Answers	Max Mark	Additional Guidance
7. (a)	X= arteriole Y = capillary	1	Artery is incorrect
(b)	oxygen, glucose, amino acids, fatty acids, glycerol, vitamins, minerals <b>any 2</b>	1	
(c)	The <u>muscle cells / muscles</u> started <u>respiring</u> anaerobically / without oxygen.	1	
(d)	By the lymphatic system / lymphatic capillaries / lymphatic vessels / lymph.	1	Lymph nodes are incorrect.

Question	Expected Answers	Max Mark	Additional Guidance
8. (a)	0.3	1	
(b) (i) (ii)	75 5250  <b><i>NB – if answer to b(i) is incorrect check if <math>70 \times b(i) = b(ii)</math> and if it does mark it correct.</i></b>	1  1	If they use 48 the correct answer is 3360. If they use 120 the correct answer is 8400. If they use 200 the correct answer is 14 000.
(c)	1. (Increase is) controlled by the medulla / autonomic nervous system. 2. <u>Sympathetic</u> nervous system affects the <u>SAN</u> / <u>pacemaker</u> 3. <u>Adrenaline</u> <u>increases</u> heart rate	3	

Question	Expected Answers	Max Mark	Additional Guidance
<p>9. (a) (i)</p> <p>(ii)</p> <p>(iii)</p>	<p>A fall in <u>body</u> temperature below normal / below 37°C / to very cold levels / to low levels / below 35°C / to critical levels.  <b>or</b>  The inability to maintain body temperature <u>up to</u> the normal range / <u>at</u> 37°C .</p> <p>Their <u>temperature</u> regulation mechanism / shivering / vasoconstriction is less efficient / slower.  <b>or</b>  Hypothalamus / receptors do not detect <u>temperature</u> changes so quickly / are less efficient at detecting <u>temperature</u> changes  <b>or</b>  They have a slower rate of <u>metabolism</u> / less efficient <u>metabolism</u></p> <p>They have a large / high surface area to volume / mass ratio (so lose more of their heat).</p>	<p>1</p> <p>1</p> <p>1</p>	<p>'When someone gets very cold / is exposed to cold' is incorrect as body temperature is not specified.  'When body temperature drops' is incorrect as level is not specified.</p> <p>Answers relating to lack of activity/lack of muscle are incorrect</p> <p>Surface area to size ratio is incorrect.</p>
<p>(b) (i)</p> <p>(ii)</p>	<p>Hypothalamus</p> <p>1. (Heat loss) through <u>evaporation</u> of <u>water/sweat</u> (from skin)</p> <p>2. (Heat loss) by <u>increased/more blood</u> flowing/diverting to the skin/surface  <b>or</b>  by <u>increased radiation</u> (of heat) from blood / skin / surface</p>	<p>1</p> <p>2</p>	<p>Hyperthalamus is incorrect</p> <p>Heat evaporates is incorrect.  'Sweat turns to <u>water vapour</u> cooling skin' is correct as this describes evaporation.</p> <p>'Blood /blood vessels <u>rising</u> to skin surface' is incorrect</p>

Question	Expected Answers	Max Mark	Additional Guidance
10. (a)	Arrow correctly drawn / going left to right	1	Arrow going along a dendrite into the cell body is correct
(b)	DNA / gene / nucleus codes for <u>neurotransmitter</u> / enzyme which makes/breaks down the <u>neurotransmitter</u> . <b>or</b> 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.
(c)	Mitochondrion/mitochondria <u>and</u> Stores / contains / carries / releases / provides <u>neurotransmitter</u> / <u>acetylcholine</u> / <u>noradrenaline</u> .	1	
(d) (i)	Has less / no myelin (sheath) <b>or</b> Has fewer / less dendrites / synaptic knobs	1	
(ii)	Slower <u>impulses</u> / fewer <u>impulses</u> reach the synaptic cleft <b>or</b> <u>Threshold</u> less likely to be reached / less <u>neurotransmitters</u> released into the synaptic cleft <b>or</b> Less connections to other nerve cells	1	Slower signals is acceptable Slower messages is incorrect

Question	Expected Answers	Max Mark	Additional Guidance
11 (a)	Corpus callosum	1	
(b) (i)	<ol style="list-style-type: none"> <li>1. The word key / information from left eye went to the right (cerebral) hemisphere .</li> <li>2. The right hemisphere controls / moves the left hand (so key is picked up).</li> <li>3. The word spoon / information from right eye went to the left hemisphere .</li> <li>4. Information cannot be transferred to the right hemisphere / from the left hemisphere. (so spoon is not picked up)</li> </ol> <p style="text-align: center;"><b>All four points needed for two marks. Two or three points needed for one mark.</b></p>	2	<p>Insert appropriate number where point given is correct.</p> <p>'Side of brain' is incorrect but only penalise it once.</p> <p>Information cannot be transferred between the hemispheres is not sufficient.</p>
(ii)	<p>Prediction – Spoon</p> <p>Reason – Spoon / information from the right eye goes to the left (cerebral) hemisphere /side of brain which controls language production / speech.</p>	1  1	<p>There are three parts to this answer – source, destination and function.</p>

Question	Expected Answers	Max Mark	Additional Guidance
12. (a)	It results in a <u>motor pathway</u> / <u>motor memory</u> / <u>neural pathway</u> / <u>neural circuit</u> / <u>procedural memory</u> being established.	1	
(b)	Approximate / improved / good behaviour is <u>rewarded</u> / <u>reinforced</u> / <u>praised</u> . <b>1 mark</b>  Only <u>successive</u> / <u>over time improvements</u> are rewarded / reinforced / praised. <b>1 mark</b>	2	
(c) (i)	Generalisation	1	
(c) (ii)	She is <u>persuaded/convinced</u> (by friends / the media / relatives / others).	1	Influenced by others is incorrect as this could be identification.
(d)	Name - deindividuation  Cause - Loss of personal identity / personality / sense of individuality. <b>or</b> Gain of anonymity / 'facelessness'.	1  1	Deindividualisation is incorrect  They think that they are less likely to get caught is incorrect. They want to feel part of a group / peer pressure is incorrect.





Question	Expected Answers	Max Mark	Additional Guidance
14. (a)	Correct scale on Y axis and correct labels on both axes – <b>1 mark</b> Bar heights correctly drawn and bars same width – <b>1 mark</b> Bars distinguished / key used to show nitrate and phosphate – <b>1 mark</b>	<b>3</b>	Concentration (mg/l) not sufficient for label. Concentration of chemicals (mg/l) is sufficient. Must have 'river' label on horizontal axis. Remove one mark for a line graph. Remove one mark for axes wrong way round
(b)	The source of the pollution / contamination is river B / around river B / enters the loch through river B.	<b>1</b>	Statements of results are insufficient
(c)	1. All collected on same day / at same time. 2. Water collected from same depth / distance from bank at each site. 3. Water collected from same distance from loch / up each river. 4. Same <u>volume</u> of water / sample collected. <b>Any two</b>	<b>1</b>	Temperature of water is incorrect.
(d)	Take more than one sample <u>from each river</u> . <b>or</b> Repeat the procedure <u>with each river</u> .	<b>1</b>	Do not penalise if candidate suggests at different times of day or at different positions in the river provided they are taking more samples from each river.
(e)	Take samples at intervals along the length of each river / river B. <b>or</b> Take samples from the land / study land use at intervals along the length of each river / river B.	<b>1</b>	

Question	Expected Answers	Max Mark	Additional Guidance
(f)	Fertilisers are not added to crops in winter. <b>or</b> Decomposition is slower/less bacteria in winter. <b>or</b> There is a higher volume of water in the rivers in winter. <b>or</b> Frozen soil so no run-off / leaching from land.	1	Converse in summer is acceptable.
(g)	1. Rapid growth of algae / an algal bloom 2. Increased numbers of bacteria / decomposition 3. Decrease in oxygen concentrations 4. Death of fish / invertebrates / animals / plants 5. Disruption of the food web 6. Reduction in biodiversity.  <p style="text-align: right;"><b>Any two</b></p>	1	

## Section C

1A Give an account of transport across the cell membrane under the following headings:

### **Structure of the cell membrane**

**3 marks**

1. Membranes are composed of proteins and lipids arranged in a bilayer / two layers.
2. Fluid mosaic model
3. Proteins span membrane and are on the surface of the membrane
4. Some proteins provide channels / antigens / enzymes / receptors / carriers **any two**

### **Osmotic effects on cells**

**2 marks**

5. Osmosis is the movement/diffusion of water down a concentration gradient.
6. Water enters cells when in a (more) dilute solution and water leaves cells when in a (more) concentrated solution
7. Cells should be at the same concentration as surrounding fluid / tissue fluid / plasma / blood

### **Endocytosis and exocytosis**

**5 marks**

8. Endocytosis is movement of molecules/substances/materials/chemicals into cell
9. Membrane/cell folds around / engulfs molecule
10. Vesicle / vacuole forms
11. Phagocytosis involves taking in solid particles/insoluble molecules/bacteria (into the cell)
12. Pinocytosis involves taking in liquids/antibodies (into the cell)
13. Exocytosis is movement of molecules/substances/materials/chemicals out of the cell
14. Vesicle fuses / joins with membrane and releases contents

**Total 10**

1B Give an account of the process of meiosis under the following headings:

### **First meiotic division**

**6 marks**

1. Chromosomes consist of two chromatids
2. Chromosomes arrange themselves into homologous pairs
3. Crossing over occurs
4. Chromosomes / chromatids / homologous pairs swap / exchange genes/alleles
5. At points called chiasmata
6. Pairs of chromosomes / homologous pairs line up at the equator / middle of the cell
7. Independent / random assortment / alignment / segregation occurs
8. Spindle separates homologous chromosomes / chromosome pairs

### **Second meiotic division**

**2 marks**

9. Chromosomes line up along the equator / middle of the cell
10. Chromatids are separated (into separate cells)
11. Four daughter (sex) cells / gametes are formed

### **Significance of the process**

**2 marks**

12. Provides (genetic) variation
13. Leads to the production of haploid gametes / cells
14. The gametes contain half the number of / 23 chromosomes
15. Leads to establishment of diploid chromosome number / full (chromosome) complement / 46 chromosomes at fertilisation

**Total 10**

2A Describe how the liver contributes to the composition of the blood.

8 marks

1. Liver removes oxygen (from the blood) / adds carbon dioxide (to the blood)
2. Amino acids are broken down / deamination occurs
3. Urea is released / produced
4. Hepatic portal vein carries digestion products / glucose / amino acids to liver
5. Insulin stimulates/promotes/causes conversion of glucose to glycogen (not 'converts')
6. Glucagon stimulates conversion of / converts glycogen to glucose
- 6a. **If no mark awarded for points 5 & 6**, give mark for **either** glucose removal & storage as glycogen **or** breakdown of glycogen and addition of glucose to blood
7. Detoxification / removal of toxins (from blood)
8. Example given such as alcohol / drugs
9. Proteins / lipids / cholesterol are added to blood
10. Red blood cells are removed / haemoglobin is broken down
11. Liver stores iron
12. Liver produces /removes / absorbs bilirubin
13. Stores vitamins / vitamin A and D

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:*

heat production, bile release from gall bladder, bile salts

**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.

**Total 10**

**2B Describe how the kidney brings about changes in the composition of the blood. 8 marks**

1. Kidney removes oxygen (from the blood) / adds carbon dioxide (to the blood)
2. Glomerulus is where blood is filtered / ultrafiltration occurs
3. Filtrate / fluid passes into Bowman's capsule.
4. (Red) blood cells / proteins remain in blood / not filtered / too large.
5. Water/glucose/amino acids/vitamins/salts/sodium/minerals/urea pass through (**any two named linked to filtration**)
6. High pressure due to difference in width of (blood) vessels (not capillaries) entering and leaving glomerulus.
7. Glucose is reabsorbed (back into the blood)
8. Reabsorption takes place in proximal convoluted tubule
9. (Most) urea is not reabsorbed
10. Water is reabsorbed / salts are removed in the Loop of Henle
11. ADH increases/causes reabsorption of water / controls the water concentration of the blood / osmoregulation
12. ADH makes collecting duct / kidney tubules more permeable
13. (More) ADH is produced when there is a low water concentration in blood (or vice versa)

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:*  
other hormones, exercise, sweating, alcohol

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

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]