SCOTTISH QUALIFICATIONS AUTHORITY

# 2004 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 $7.3 \pm 0.1$.

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 is 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 √ or *x* near answers will do.

12. **Totalling scripts:** errors in totalling can be more significant than errors in marking:

- enter a correct and carefully checked total for each candidate
- do not use running totals as these have repeatedly been shown to lead to more errors.

**2004 Human Biology Higher**

**Marking scheme**

**Section A**

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

**Section B**

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **1 (a)** | $CO_2 + H_2O$ (1)<br>ADP + $P_i$ (or phosphate) (*i not essential*) (1)<br>amino acids or (poly) peptides (1) | **3** | | |
| **(b) (i)** | Glycolysis in cytoplasm<br>OR<br>Krebs cycle in mitochondrion/matrix of mitochondrion<br>OR<br>Cytochrome chain in mitochondrion/cristae of mitochondrion<br>OR<br>Electron/hydrogen transport system/chain | **1** | Location: Matrix or cristae on their own | |
| **(ii)** | Ribosome | **1** | Rough ER | |
| **(c)** | No oxygen (1) Lactic acid instead of $CO_2 + H_2O$ (1)<br>No pathway X (1)<br>$CO_2$ or $H_2O$ not produced (*1 mark if given separately*) | **2** | Only glycolysis would occur<br>Less ATP produced | |
| **(d)** | Lipid/fat/fatty acid/glycerol/protein/amino acid/glycogen/ maltose/sucrose. | **1** | Carbohydrate/starch/lactic acid | |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **2 (a)** | <table><tr><td></td><td>**H**</td><td>**h**</td></tr><tr><td>**H**</td><td>**HH**</td><td>**Hh**</td></tr><tr><td>**h**</td><td>**Hh**</td><td>**hh**</td></tr></table> *(one mark for correct gametes and one mark for correct $F_1$)* | **2** | | |
| **(b)** | 1 25<br>2 50<br>3 25 (*% sign not necessary*) | **1** | | |

<table>
<tr><th>Question</th><th>Acceptable Answer</th><th>Mark</th><th>Unacceptable Answer</th><th>Negates</th></tr>
<tr><td>3 (a)</td><td>
<table>
<tr><th>Type of Cell</th><th>Secretion of antibodies (yes/no)</th><th>Type of response</th></tr>
<tr><td>B-lymphocyte</td><td><u>Yes</u></td><td><u>Humoral</u></td></tr>
<tr><td><u>T-lymphocyte</u><br><u>Killer T-cell</u></td><td>no</td><td>cell-mediated response</td></tr>
<tr><td><u>Macrophage/ monocytes</u><br><u>Neutrophyll/ phagocyte</u></td><td><u>No</u></td><td>non-specific response</td></tr>
</table>
(1) (1) (1)
</td><td>3</td><td>Helper T-cell<br><br>Phagocytosis</td><td></td></tr>
<tr><td>(b)</td><td>Arrow should be pointing downwards, towards the lymph node. Any lymph vessel OK<br><br>Any qualified reference to valve eg. its shape or closing to prevent backflow</td><td>1</td><td>Valve present (unqualified)</td><td></td></tr>
<tr><td>(c)</td><td>It has no/less proteins in it<br>OR<br>It has more lipids/fats/fatty acids/glycerol in it</td><td>1</td><td>It has no cells/no red blood cells<br>It has lipids<br>It contains waste<br>It does not contain oxygen</td><td></td></tr>
<tr><td>(d)</td><td>It rejoins the main circulatory system/blood</td><td>1</td><td>Secreted/absorbed/reabsorbed into the blood</td><td></td></tr>
</table>

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **3 (e)** | Removal of tissue fluid<br>OR<br>Transport/absorption of lipids/fats (from digestive system) | **1** | Removes toxins<br>Transport of tissue fluid/lymph<br>Removes excess fluid from the blood | ..to digestive system |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **4 (a)** | 136/82 | **1** | | |
| **(b)** | That caffeine causes an increase in blood pressure | **1** | | Coffee rather than caffeine |
| **(c)** | Students given a cup of decaffeinated coffee/water/drink of same volume with no caffeine | **1** | No drink<br>Tea | |
| **(d)** | Volume/strength/concentration/type of coffee<br>Time taken to drink coffee<br>Activity before and after taking readings<br>Activity during the hour between readings<br>Ingestion of other food<br>Same sphygmomanometer<br>Same temperature of room/coffee<br>Mass of caffeine | **1** | Same age of students<br>Volume of caffeine | |
| **(e)** | Systolic – (maximum pressure) when heart is contracting<br>Pressure to stop blood flood in artery (1)<br>Diastolic – (minimum pressure) when heart is relaxing<br>Pressure to allow free flow of blood in artery (1) | **2** | When heart is pumping<br>When heart is not pumping | When exercising<br>When resting |
| **(f) (i)** | 3 | **1** | | |
| **(ii)** | 15 (75-60) | **1** | | |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **5 (a)** | A Oviduct/fallopian tube<br>B Ovary | **1** | Uterine tube/egg tube | |
| **(b)** | Cleavage | **1** | | |
| **(c)** | Oestrogen produced by ovary/follicle<br>OR<br>Progesterone produced by corpus luteum | **1** | | |
| **(d)** | Placenta | **1** | Chorion (*not an organ*) | |
| **(e)** | Monozygotic twins develop from one egg fertilised by one sperm (1)<br>The zygote/ball of cells divides into two separate individuals<br>OR<br>egg splits into two after fertilisation (1)<br>Dizygotic twins develop from two eggs fertilised by two sperm (1) | **3** | *Mono 1 and Dizig 2 with no mention of sperm = 1 mark*<br>*No marks for reference to placenta*<br><br>egg splits/divides | |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **6 (a)** | (135 declining to 90) 33 OR 33·3 | **1** | | |
| **(b)** | 145 | **1** | | |
| **(c)** | Because the concentration of insecticide increases/builds up as it is passed along the food chain<br>(*must be reference to increase*) | **1** | They ate all the animals which ate all the plants | |
| **(d)** | FSH | **1** | | |
| **(e)** | Prostate, Cowper's (bulbourethral) gland or seminal vesicle<br><br>Nourishment/activation/source of sugar (fructose) for sperm<br>Provides food/energy for sperm<br>Stimulates contraction of the uterus<br>Provides a medium for sperm to swim in<br>Optimum/alters viscosity for (motility of) sperm<br>Stimulates sperm to swim<br>Affects pH of vagina | **1**<br><br>**1** | Prostrate<br><br>Lubricates sperm | |
| **(f)** | **artificial insemination:** sperm injected into womb by syringe/mechanically/by method other than sexual intercourse. (1)<br>(*implication that process is artificial and not natural*)<br>***in vitro* fertilisation:** fertilisation takes place outside the uterus/in glass dish/test tube (1) | **2** | | |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **7 (a)** | Polygenic | **1** | | |
| **(b)** | ABO<br>A B AB and O | **1** | | |
| **(c)** | Cell membrane/plasma membrane<br>Surface of cell | **1** | Protein coat<br>Outside the cell<br>The membrane | |
| **(d)** | If father is homozygous/**DD**, child will be Rh +ve (1)<br>If father is heterozygous/**Dd**, child has 50% chance of being Rh +ve (1) | **2** | | |
| **(e)** | (Exchange) blood transfusion of the baby can be carried out<br>OR<br>Mother can be injected with anti-D antibody/ immunoglobin/drugs to destroy antigens<br>(*no penalty for type of blood transfused*) | **1** | Mother injected with immunosupressor | |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **8 (a)** | 1236 | **1** | | |
| **(b)** | 6435 +/- 1 *(3.1% increase during previous year)* | **1** | | |
| **(c)** | The immune system recognises the transplant tissue as foreign (1) (Without suppression), it would attack the transplant and destroy it (1) | **2** | | |
| **(d)** | Renal artery and vein (*accept also,* iliac artery or vein) | **1** | | |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **9 (a)** | Cerebrum/cerebral hemispheres/cortex | **1** | | |
| **(b)** | To control (muscle) movements/to send impulses to effectors/muscles | **1** | Controlling specific body parts<br>Allow muscles/body to move | |
| **(c)** | The hands have much more (fine) motor control<br>The hands have many more muscles<br>The hands carry out complex tasks<br>*(comparison with feet not required)* | **1** | We do more with our hands<br>We use our hands more | |
| **(d)** | Diverging | **1** | | |
| **(e)** | Non-verbal (communication) | **1** | Body language | |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **10 (a)** | Axon | **1** | | |
| **(b) (i)** | Neurotransmitter | **1** | | |
| **(ii)** | An (electrical) impulse/ionic change | **1** | | |
| **(iii)** | It is removed by enzyme action | **1** | Reabsorbed<br>Broken down | |
| **(c)** | Q – myosin<br>R – actin | **1** | | |
| **(d)** | They slide together (to shorten the muscle)<br>They pull together<br>They come closer together<br>They overlap more<br>(*diagram helps*) | **1** | | Any reference to contractions |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **11 (a)** | The population which can be sustained by an ecosystem/ environment<br>The number of a species which an environment/habitat can support | **1** | The quantity of cod held in the North Sea<br>The optimum population<br>The highest population possible | |
| **(b) (i)** | 10:1 | **1** | | |
| **(ii)** | over-fishing/better boats/more boats/increase in fishing<br>better detection equipment<br>bigger nets/smaller mesh<br>an increase in pollution eg pesticides<br>the spread of disease<br>disturbance/decrease to its food supply<br>increased demand from human population<br>climate change eg the warming of the ocean<br>*(Any 2 – 1 mark each)* | **2** | Algal blooms<br>Fertiliser<br>More predators | |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **12 (a) (i)** | Birth rate – 44 Death rate – 37 | **1** | | |
| **(ii)** | Introduction of contraception/improved economic conditions/emancipation of women/improved education/ reduced male fertility/increased costs in raising a family/ No longer a need for large families for economic and social support | | | |
| | By government laws/advertising/persuasion | **1** | | |
| **(iii)** | Improved sanitation/health service/diet/hygiene | | Because life expectancy has risen | |
| | Introduction of vaccination programme | **1** | Better quality of life | |
| **(b)** | Increasing (*no mark for this answer*) | | | |
| | Because death rate is (always) lower than the birth rate (*must be comparison of deaths/births*) | **1** | | |
| **(c)** | **A** (*no mark for this answer*) | | | |
| | because the rate of population increase is increasing | | Birth rate higher than death rate | |
| | because the birth rate is high | | Death rate falling more than birth rate | |
| | because the death rate is high | **1** | | |

| Question | Acceptable Answer | Mark | Unacceptable Answer | Negates |
|---|---|---|---|---|
| **13 (a)** | 1 mark for correct axes with <u>units</u><br>1 mark for correct graph<br>Graphs can be on separate pages (eg use of p32)<br>1 mark for key/line labels | **3** | No extrapolation | |
| **(b)** | The absence of nitrate inhibits growth/nitrates stimulate growth<br>Better/quicker growth with nitrates than without (*comparison required*) | **1** | Nitrates are essential/needed for growth<br>Nitrates needed for steady growth<br>Nitrates necessary for optimal growth<br>Nitrates important for growth | |
| **(c)** | The control is tube A. (no mark for this answer)<br>It contains the complete set of minerals/nitrates to show how plants grow under normal conditions/with nitrate | **1** | 'A' is normal conditions | |
| **(d)** | More than one seed was grown in each condition<br>Batches of seeds were grown | **1** | An average was calculated | |
| **(e)** | To make sure there were no nitrates in the water | **1** | Because it is clean<br>Because it does not contain bacteria<br>To ensure no variables from tap water | |
| **(f)** | DNA/RNA/nucleotide/nucleic acid/phosphoric acid<br>phospholipid/NADP/RuBP/GP/Triose phosphate/G-6-P<br>Ammonium phosphate | **1** | Steroids/fertiliser/sewage/lipid<br>Cytochrome phosphate/Nitrogen phosphate | |

**Section C**

**1A**

(i)
1 Capacity - around 7 pieces of information (+/- 1)
2 Held for a very short period of time/seconds only
3 This is memory span
4 Chunking + example of chunking
5 Serial position effect *or* description of SPE
6 Encoding + description (eg acoustic, semantic, visual)

7 Located in limbic system/hippocampus (*can be gained in either (i) or (ii)*)

**(4)**

(ii)
8 Rehearsal
9 Repetition of items to be memorised
10 Organisation
11 Putting items into groups or categories
12 Elaboration
13 Putting meaning to items/adding additional information to items
14 Mnemonics (memory aids/systems) + description *or* example
15 Memory maps/mind mapping/visual imagery + description or example

**(6)**

*Not contextual cues*

*Chunking in part (ii) OK, but can only credit marks in part (i)*

**1B**

(i) *Any of the following with short description (1 mark each)*
1 Irrigation
2 Terracing *or* increase in size of fields
3 Crop rotation *or* monoculture
4 Deforestation
5 Drainage/flood control
6 Reclamation (sea/desert/marginal land)
7 Mechanisation **(4)**

(ii)
8 Fertilisers
9 Function - promotes growth of plants
10 Examples - nitrates/phosphates etc
11 Pesticides
12 Fungicides kill fungi/moulds
13 Herbicides/weedkillers kill weeds
14 Insecticides kill insects (*max of two for these three examples*)
15 Antibiotics to protect animals against disease
16 Hormones + simple description in plant or animal husbandry eg growth promoters.

**(6)**

*Use of terms without description (2 terms = 1 mark, 3 terms = 2 marks)*

**2A** 1 Meiosis as nuclear/cell/reduction division to produce sex cells/sperm and eggs *(ie definition of meiosis which includes knowledge of what a gamete is)*
2 Pairing of homologous chromosomes
3 Crossing over occurs
4 Chromatids break and rejoin/genetic exchange (*labelled diagram accepted*)
5 These points are called chiasmata
6 Chromosomes line up along equator
7 Assortment is independent *or* explanation (*labelled diagram accepted*)
8 Describe numerically. eg 23 pairs gives over 8 million different combinations
9 Non-disjunction
10 This is a form of mutation
11 Description of non-disjunction
12 Example of non-disjunction - eg Down's syndrome

**1 mark for coherence and 1 mark for relevance**

**Maximum total = 10 marks**

**Coherence**

1 The writing should be under sub-headings or divided into paragraphs.
2 Related information must be grouped together.
3 The account must be presented in a logical and progressive way.

Any two of the above with at least 5 correct points overall.

**Relevance**

1 Must not give details of mitosis *and* fertilisation *and* description of testes/ovaries/hormones *and* X/Y chromosomes.
2 Must give at least 5 correct points overall.

**2B**

1 mRNA takes code from DNA/nucleus to...
2 site of activity - ribosomes or rough ER
3 mRNA contains codons
4 tRNA contains an anticodon
5 a codon/anticodon consists of three bases
6 tRNA carries a specific amino acid (*labelled diagram OK*)
7 codons match/link up/pair with anticodons
8 bases match. ie. U to A and G to C (*both pairings required - diagram OK*)
9 results in amino acids lining up
10 peptide bonds join amino acids to make peptide/polypeptide/protein
11 the sequence of bases/codons = sequence of amino acids
12 there is a requirement for ATP and enzymes

**Coherence**

1 The writing should be under sub-headings or divided into paragraphs.
2 Related information must be grouped together.
3 The account must be presented in a logical and progressive way.

Any two of the above with at least 5 correct points overall.

**Relevance**

1 Must not give details of DNA replication/transcription *and* DNA structure *and* exocytosis.
2 Must give at least 5 correct points overall.

[END OF MARKING INSTRUCTIONS]