

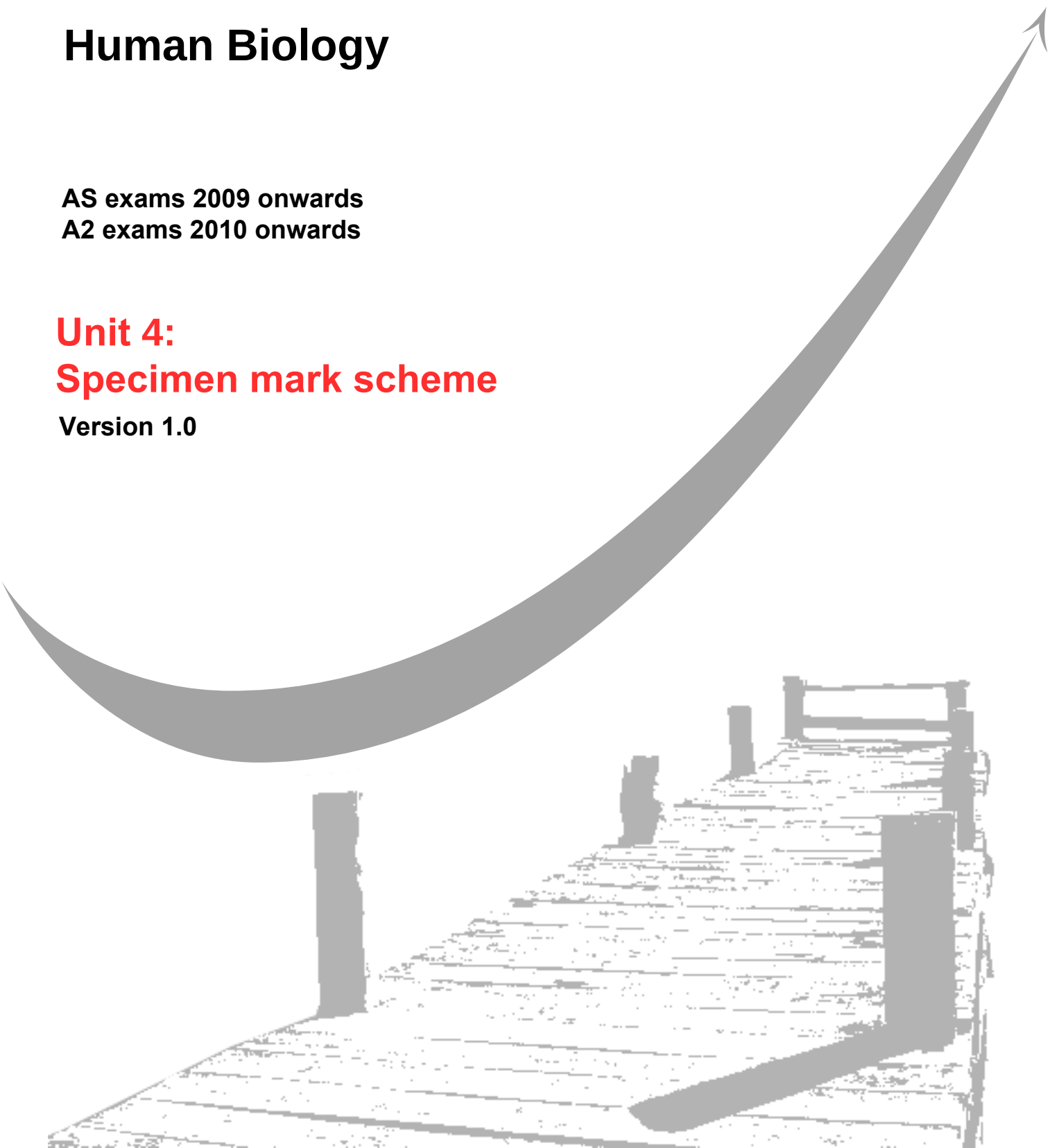
GCE
AS and A Level

Human Biology

AS exams 2009 onwards
A2 exams 2010 onwards

Unit 4: **Specimen mark scheme**

Version 1.0





General Certificate of Education

Human Biology 2405

HBIO4 Bodies and cells in and out of control

Mark Scheme

Specimen Paper

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Question 1

- | | | |
|-----|--|---|
| (a) | To separate the DNA strands/break hydrogen bonds; | 1 |
| (b) | To allow free nucleotides to bind; | 1 |
| (c) | To give starting point for DNA polymerase; | 1 |
| (d) | Optimum temperature for DNA polymerase;
To join newly bound nucleotides together; | 2 |

Total 5**Question 2**

- | | | |
|-----|--|-------|
| (a) | A lot of overlapping of thick and thin filaments;
I band/actin band very narrow;
H band very narrow; | 2 max |
| (b) | (i) Bind to troponin/tropomyosin;
(Causing) exposure of myosin binding site on actin;
Activates myosin ATPase; | 2 max |
| | (ii) Binds to/reacts with myosin ATPase;
Myosin detaches from actin;
Myosin head moves/swings; | 2 max |

Total 6**Question 3**

- | | | |
|-----|--|---|
| (a) | (i) Study involving many people in each category /
of particular ages at the same time; | 1 |
| | (ii) $\frac{21 - 4}{6} = 2.8$ | |
| | $\frac{48 - 32}{4} = 4.0$ | |
| | $\frac{4 - 2.8}{2.8} \times 100 = 43\%;$ | 2 |
| | <i>(Correct answer of 43% score two marks no matter how derived)</i>
<i>(1 mark for first two stages shown or last stage shown with wrong answer)</i> | |
| (b) | Puberty occurs;
(Caused by) increased secretion of growth hormone;
(In response to) increased secretion of oestrogen / sex hormones; | 2 |

Total 5

Question 4

- (a) (Mutations can) produce new alleles/genes; 1
- (b) (i) Range between extremes/quantitative/ non-categorical; 1
- (ii) Discrete types/categories/qualitative; 1
- (c) (i) Same genotypes, so differences in occurrence environmental; 1
- (ii) Same environment with different genotypes, so differences due to genotype; 1

Total 5**Question 5**

- (a) (i) FSH; 1
- (ii) Oocytes; 1
- (iii) Process by which sperm mature, to be able to fertilise an egg; 1
- (iv) Suitable reason;
e.g. Stop menstrual cycle; 1
- (b) Suggestion; with reason; 2
- e.g. Sperm less motile;
Because slower rate of respiration at lower temperature/enzymes work slower;

Total 6**Question 6**

- (a)
- | Allele | Antigen | Antibody |
|----------------|-------------|----------------|
| I ^A | A | B |
| I ^B | B | A |
| I ^O | None | A and B |
- 2
- (b) (i) Parental genotypes, Ss and Ss;
Offspring genotypes, SS, Ss, ss;
Secretor SS and Ss and non-secretor ss; 3
- (ii) Antigen in mother's milk binds with virus;
reduces virus to bind with baby's cells; 2

Total 7

Question 7

- (a) (i) **1 and 2 synapse with 1 relay neurone but 2 and 3 synapse with 2 relay neurones;** 1
- (ii) 1 unit is sub-threshold;
(1 unit) no impulses in (sensory) neurone / does not stimulate sensory neurone;
(Spatial) summation with 3 receptors / sufficient neurotransmitter released; 3
- (b) (i) Supports,
For some facial expressions but not others;
Fear especially;
Surprise and sadness to some extent;
Happiness, anger and disgust probably not;
Possible anomalous result for anger; 2 max
- (ii) Facial expressions one of our behavioural adaptations;
Used in non-verbal communication;
Difficulty in judging the mood of others; 2 max

Total 8**Question 8**

- (a) Oestrogen able to cross lipid bilayer;
Oestrogen binds to receptor and changes its shape;
Receptor binds to regulator gene;
Gene for mitosis protein transcribed;
Mitosis protein promotes cell division; 4 max
- (b) (i) Tamoxifen very similar shape to oestrogen, so binds to oestrogen receptor;
So mitotic divisions reduced; 2
- (ii) Able to bind to oestrogen receptors in other cells;
Can mimic actions of oestrogen; 2

Total 8

Question 9

- (a) (i) Depolarisation;
As sodium ions diffuse in across membrane;
Sodium channel proteins open;
Potassium channels open and start re-polarisation;
Sodium channels close; 3 max
- (ii) Ethics of experiments on live animals;
Can not control variables;
Results reflect what happens in normal life; 2 max
- (b) Cocaine prevents reabsorption of dopamine;
So get continuous stimulation of reward centre; 2
- (c) PET scans, show areas of brain that are active;
produce '3D' images of brain; 2
- Total 9**

Question 10

- (a) (i) Hypothermic patients' median temperature 1.7°C below non-hypothermic;
Median age 7 years older; 2
- (ii) Positive feedback;
The lower the temperature, the lower the rate of enzyme activity;
So the lower the rate of respiration and heat generation; 2 Max
- (iii) Ages not normally distributed, median gives middle of the range; 1
- (b) (i) Two criticisms;;

e.g. No divisions on x axis to indicate where in months events occur;
Data points as approved symbols;
Vertical axis, text should be horizontal/ units should be presented as °C;
Should plot temperature of hypothermic patients separately; 2 Max
- (ii) The lowest mean core temperatures for all patients did coincide
with two times with very low minimum ambient temperatures;
Other periods of low ambient temperature no apparent correlation; 2
- (c) Highest percentage of hypothermia in poor areas;
Suggested reason relating to housing;
e.g. Poor unable to afford to heat their homes; 2
- Total 11**

Question 11

- (a) Suggestion with explanation;;
e.g. Oestrogen is a female sex hormone;
May affect development in male embryos/puberty; 2
- (b) Two suitable suggestions;;
e.g. Use of contraceptive pill;
Increase in size of population (and thus of oestrogen in total volume of urine); 2
- (c) Synthesised from mRNA using reverse transcriptase;
Synthesised from amino acid sequence in protein, using nucleotides in gene machine;
Cut from DNA using restriction enzymes; 2 max
- (d) Receptor protein has specific shape/tertiary structure;
Only oestrogen can fit to receptor/has complementary shape; 2
- (e) Two variables that affect enzyme activity, explained;;
*Note: **not** concentration of enzyme.*
e.g. Temperature;
At optimum for galactosidase; 2
e.g. Substrate/BAPNA concentration;
To get constant colour change; 2
- (f) Range,
(Approx.) 100 to 10⁵ ng per litre; 1
Explanation,
In this range the enzyme activity increases proportionately with oestrogen;
Above this range, response falls;
Below this range, little response/not sensitive enough; 2 max
- (g) Each oestrogen (complex) causes transcription of lots of mRNA molecules;
Each complex may remain active for a long time;
Each mRNA may be used many times;
Be read by many ribosomes at the same time; 3 max
- (h) Method for controlling temperature;
Method for finding end-point/certain colour change;
Timing to end-point; 3
- (i) Inactivated viruses may become active again and cause disease;
Antigens on their own cannot do this;
Antigens stimulate same B cells/lymphocytes as would the virus;
Same type of memory cells produced;
Produce same antibodies in secondary response; 4 max

Total 25