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General Certificate of Education (A-level)
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Human Biology HBIO2

(Specification 2405)

Unit 2: Humans - their origins and adaptations

Final

Mark Scheme

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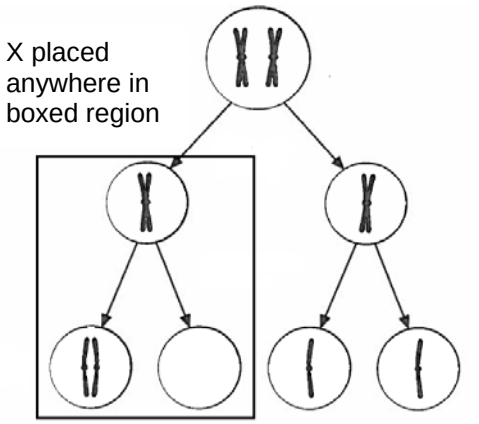
<table>
<tr><th>Question</th><th>Marking guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>1 (a)</td><td>
<table>
<tr><th>Advantage</th><th>Adaptation</th></tr>
<tr><td>Smiling at a stranger means you are not a threat</td><td>A</td></tr>
<tr><td>Signals can be understood even if languages spoken differ</td><td>A</td></tr>
<tr><td>Reproduction normally occurs when socially mature</td><td>C</td></tr>
<tr><td>Allows time for learning of complex tool use</td><td>C</td></tr>
</table>
;;;
</td><td>3</td><td>4 correct = 3 marks
3 correct = 2 marks
2 correct = 1 mark
0/1 correct = 0 marks</td></tr>
<tr><td>1 (b) (i)</td><td>1. The ability to look over taller vegetation/spot predators/food sources;
2. Frees limbs for other functions, e.g. better fighting skills by swinging arms/using arms/hands to communicate/signal/can throw things/example of carrying things off the ground (such as food, tools and baskets);
3. Allows more efficient/faster movement/run for longer;
4. Reduced exposure of skin to sun / increased exposure to cooler air;</td><td>2 max</td><td></td></tr>
<tr><td>1 (b) (ii)</td><td>1. Can grip object/tool/weapon/example of;
2. Can make tools/weapons;</td><td>1 max</td><td>1. Credit references to power and precision gripping</td></tr>
</table>

Question	Marking guidance	Mark	Comments
2 (a) (i)	Letter D drawn inside any of the deoxyribose sugars;	1	Accept arrows/lines clearly marking a deoxyribose sugar
2 (a) (ii)	Letter E drawn inside any of the bases;	1	Accept arrows/lines clearly marking a base
2 (a) (iii)	Line enclosing one of each three shapes (one deoxyribose, 1 phosphate and 1 base);	1	
2 (b)	Hydrogen bonds (between the bases);	1	
2 (c)	Condensation;	1	Accept polymerisation
2 (d)	(The) sequence of amino acids (in proteins);	1	

Question	Marking guidance	Mark	Comments
3 (a)	Preserved remains of a (once) living organism;	1	Accept suitable examples of remains, eg bones, teeth
3 (b)	(The majority of) organisms/remains decompose/most are not preserved/ consumed by other organisms;	1	Accept not yet found/difficult to access
3 (c)	1. Stratigraphy; 2. Potassium-argon dating; 3. Carbon dating;	2 max	

Question	Marking guidance	Mark	Comments
4 (a) (i)	Accept one valid piece of evidence, eg 1. (Dairy cattle) skeletons/bones/ teeth are adult size; 2. Altered mineral crystal structure in bones; 3. (More) cattle remains in human graves/settlements; 4. Suitable comparison with wild cattle such as smaller size/smaller horns/mainly females near human habitation sites;	1 max	Accept ideas relating to cattle being domesticated for milk production, surplus bull calves would being killed early for meat, leaving smaller skeletons/ bones/teeth Accept ideas relating to artwork/cave drawings
4 (a) (ii)	Accept two suitable suggestions, eg 1. Trades between societies; 2. (Societies) could settle where food was not in plentiful supply; 3. Development of larger societies/settlements; 4. Division of labour/example of;	2 max	
4 (a) (iii)	Land is cleared/deforestation occurs for grazing / kill competitors/ kill predators/named example;	1	
4 (b)	1. (Farmers/humans) select the best characteristics / most muscular /best cow and bull; 2. And only breed from these; 3. Over many generations/time; 4. Only 'muscular' alleles remain / increase frequency of alleles for increased muscle (mass);	2 max	1. They = farmers

4 (c)	1. Could produce milk that humans could drink; 2. Could digest cellulose so not competing with humans for food; 3. Have a herding instinct so easy to manage; 4. Carcasses/body part could be used to make tools/clothing/other suitable example; 5. Could pull ploughs/other suitable example;	2 max	Accept ideas relating to behaviour such as not aggressive towards humans 5. Accept examples of pulling carts/logs/ objects humans cannot pull

Question	Marking Guidance	Mark	Comments
5 (a)	1. (Meiosis) produces haploid gametes / chromosome number halved/diploid to haploid; 2. Prevents doubling of chromosome number; 3. During fertilisation (gametes fuse to form a zygote and the diploid/full) chromosome number is restored;	2 max	Accept gametes are haploid preventing chromosome number doubling at fertilisation for 2 marks Allow one mark for mathematical explanations, eg 23 + 23 = 46
5 (b) (i)	Cells (during meiosis II) on the left hand side, i.e.  ;	1	
5 (b) (ii)	Line enclosing gamete on the bottom left with two chromosomes;	1	
5 (b) (iii)	1. (They are) same size/length/ shape/centromeres in same position; 2. Able to 'pair up'/form bivalents/ undergo crossing over (in prophase of meiosis); 3. (They) have the same genes; 4. (At) the same loci/positions;	2 max	3. Do not accept have the same alleles

Question	Marking guidance	Mark	Comments
6 (a) (i)	Mammalia = class Rodentia = order Muridae = family ;;	2 max	All correct 2 marks, 2 correct 1 mark.
6 (a) (ii)	Three concentric circles in Rodentia with the smallest labelled C;	1	
6 (b)	1. Large groups split into smaller groups/small groups contained within larger groups; 2. With no overlap;	2	
6 (c) (i)	Based on (true) <u>evolutionary</u> relationships;	1	
6 (c) (ii)	1. (Compare) DNA; 2. More bases/nucleotides in common/more similar the sequences indicates more closely related; ***OR*** 3. DNA hybridisation; 4. Higher temperature/more heat required to separate (hybrid) strands indicates more closely related; ***OR*** 5. Compare same/named protein; 6. More similar sequence of amino acids /primary structure indicates more closely related; ***OR*** 7. Compare immune response to a protein/named protein; 8. More precipitate/antibody-antigen complex/agglutination indicates more closely related;	2 max	One suggestion with correct explanation for 2 marks

Question	Marking guidance	Mark	Comments
7 (a) (i)	1. Top layer contains virus protein coats (with radioactive sulphur); 2. In bottom layer some virus coats may still be attached to bacteria / not all virus coats separate;	2	
7 (a) (ii)	1. Bottom layer contains bacteria which have DNA containing radioactive phosphorus inside; 2. In top layer as not all of the bacteria may end up at the bottom/not all viruses infect bacteria;	2	
7 (b)	1. In tube P/tube with radioactive phosphorus (most) radioactivity is found in the bacteria; 2. This shows DNA (from viruses) enters the bacteria; ***OR*** 3. In tube S/tube with radioactive sulfur (most) radioactivity is found in protein coats; 4. This suggests protein coats do not enter bacteria;	2 max	
7 (c)	1. Increases reliability (of calculated mean); 2. Allows identification of anomalous results / allows for effect of anomalies;	1 max	1. Reject answers that relate to increasing accuracy/ precision /validity of the mean

Question	Marking guidance	Mark	Comments
8 (a)	1. *Homo neanderthalis/* neanderthal(s); 2. *Homo sapiens*;	2	Accept phonetic spellings
8 (b) (i)	(Yes) 1. The more recent the hominid the larger the cranial capacity; 2. Cranial capacity (should be) proportional to/representative of brain size; (No) 3. Data are incomplete/for some years no cranial capacity is recorded; 4. Sample size small for some years (so might not be representative); 5. Graph does not show actual brain size; 6. There are considerable/ significant overlaps in the data;	2 max	1. Accept converse. Ignore positive correlation
8 (b) (ii)	Accept three suitable explanations, eg 1. Foramen magnum is at the bottom of the skull/cranium / skull/cranium is attached at the bottom to backbone; 2. S-shaped spine makes head directly above the centre of gravity; 3. Wide/basin-shaped hipbone supports organs above (when walking); 4. Knees can lock allowing hominids to stand for long periods of time; 5. Big toe parallel with the others (adapting it for walking);	3 max	Q

Question	Marking guidance	Mark	Comments
9 (a)	Metastasis;	1	
9 (b) (i)	1. Allows comparison; 2. Different number of people in each study/group/category;	2	
9 (b) (ii)	27/28/27.2;	2	Accept 1 mark for answers clearly showing $\frac{850}{1000} \times 32$ but with input error
9 (c)	1. Increased exposure in all categories increases risk/positive correlation; 2. Difference (in number of cases per 1000) for radon gas is very small/only 1; 3. Correlation does not necessarily mean causation; 4. Other factors may cause lung cancer/named example e.g. smoking; 5. Only studied men/40-75 age category/one city; 6. Table only shows a few types of air pollutants;	3 max	4. Accept any suitable suggestion of other factor

Question	Marking guidance	Mark	Comments
10 (a) (i)	Heart rate × stroke volume	1	Accept written as equation Ignore units
10 (a) (ii)	1. Increase production of red blood cells/haemoglobin; 2. Allows more oxygen carriage/delivery (per unit of blood) / allows the same amount of oxygen to reach tissues / compensates for lower oxygen concentration of air; ***OR*** 3. Increase breathing rate/ pulmonary ventilation; 4. Allows the same amount/volume of oxygen to enter the blood;	2 max	One suggestion with correct explanation for 2 marks Accept increased nitric oxide production widens diameter of blood vessels allowing more flow for two marks
10 (b)	1. (Climbing causes) increased muscular activity; 2. Muscles respire <u>more</u>; 3. <u>More</u> carbon dioxide is produced/blood pH is lowered/falls; 4. Detected by chemoreceptors; 5. In carotid/aortic bodies/medulla; 6. Impulses sent <u>to</u> medulla/ cardiovascular centre; 7. <u>More</u> impulses <u>from</u> medulla (along sympathetic nerve) to SAN; 8. SAN sends <u>more</u> impulses increasing heart rate;	6 max	Q 3. Reject anaerobic respiration producing carbon dioxide 6. and 7. Reject signals/messages
10 (c) (i)	1. Triglycerides/fats/lipids/adipose tissue; 2. Glycogen;	2	

10 (c) (ii)	1. Not enough oxygen available for aerobic respiration; 2. Less ATP produced/released/available for muscle contraction (via anaerobic respiration); 3. Lactate/lactic acid production (increases); 4. (Lactate) lowers blood pH; 5. (Lactate) causes muscle fatigue/cramp/makes it harder to contract muscles;	4 max	Accept triglyceride sources of energy cannot be respired anaerobically 2. Do not accept less energy is <u>produced</u>

10 (d) (i)	1. Adaptation: Small surface area to volume ratio; 2. Explanation: heat is lost less easily/more heat is conserved; ***OR*** 3. Adaptation: layers of insulating fat/thicker fat/more adipose tissue; 4. Explanation: heat is lost less easily/more heat is conserved/(fat) acts as an insulator;	2 max	Do not accept thicker hair

10 (d) (ii)	Darker skin/<u>more</u> melanin in their skin;	1	Accept black/dark brown skin

10 (d) (iii)	1. (Weaker sun and darker skin means they might) not absorb as much/enough ultraviolet light; 2. (Might) not make as much vitamin D/may develop rickets;	2	1. Reject ideas relating to absorbing vitamin D from sunlight