Government of **Western Australia**
School Curriculum and Standards Authority

HUMAN BIOLOGICAL SCIENCE

Stage 3

WACE Examination 2015

Marking Key

Marking keys are an explicit statement about what the examiner expects of candidates when they respond to a question. They are essential to fair assessment because their proper construction underpins reliability and validity.

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Section One: Multiple-choice **30% (30 Marks)**

Question	Answer
1	c
2	a
3	d
4	b
5	a
6	b
7	c
8	a
9	a
10	b
11	d
12	b
13	d
14	c
15	a
16	c
17	c
18	a
19	b
20	d
21	c
22	d
23	a
24	c
25	c
26	a
27	b
28	b
29	d
30	d

Section Two: Short answer **50% (100 Marks)**

Question 31 **(14 marks)**

(a) (i) What substance is found in the area labelled C? (1 mark)

Description	Marks
Synovial fluid	1
Total	**1**

(ii) State **two** functions of the substance found in the area labelled C. (2 marks)

Description	Marks
Lubricates	1–2
Nourishes	
Helps prevent surfaces from touching/cushioning the joint	
(Contains phagocytes) to remove debris/micro-organisms	
Total	**2**

(iii) Name **one** category of freely movable joints in the human body and provide an example of where it is found. (2 marks)

Description		Marks
Pivot	atlas and axis/in the neck/arm/wrist/forearm/ radius and ulna	1–2
Ball and socket	shoulder/hip/femur and pelvis/humerus and scapula	
Hinge	humerus and ulna/femur and tibia/knee/elbow/ fingers/phalanges/ankle	
Gliding	carpal bones/tarsal bones/hand/foot	
Condyloid	metacarpal and phalanges/carpal and radius/ tarsal and phalanges/hand/wrist/foot/ temporomandibular/lower jaw to cranium	
Saddle	thumb/carpal and metacarpal	
Total		**2**

Question 31 (continued)

(b) (i) For both osteoporosis and osteoarthritis, identify which part of the joint shown in the diagram is most affected by the condition and how the joint is damaged or altered by it. (4 marks)

Description	Marks
Osteoporosis	
A/Bone	1
Decreased bone density/loss of calcium/brittle/porous/decrease bone mass	1
Osteoarthritis	
D/Articular cartilage	1
Wears away the cartilage/pain/swelling/inflammation/stiffness/ loss mobility	1
Total	**4**

(ii) Artificial joint replacement is a potential treatment for conditions where injury or damage has occurred at the joint. Identify whether artificial joint replacement is an appropriate treatment for both, one or neither of the conditions osteoporosis and osteoarthritis. Justify your answer. (3 marks)

Description	Marks
Osteoarthritis only	1
Artificial joint can replace the damaged bone surface/damaged cartilage	1
Can't work in osteoporosis because it affects more than just the joint/affects the whole bone	1
Total	**3**

(c) There are two types of bone found in the human skeleton: compact and cancellous. Contrast the two types, describing **two** structural differences between compact and cancellous bone. (2 marks)

Description	Marks
Any two of:	
• compact is more dense than cancellous	1–2
• compact is hard/more solid, while cancellous is porous	
• compact is made up of osteons (haversian systems), while cancellous is made of trabeculae/compact has parallel arrangement, while cancellous has irregular or branched arrangement	
• compact contains yellow bone marrow, while cancellous contains red bone marrow	
• compact is found in the diaphysis/shaft and epiphysis/ends, cancellous only found in epiphysis/ends	
Total	**2**

Question 32 **(15 marks)**

(a) Although different diseases, Alzheimer's disease and Parkinson's disease are similar in that they both affect the brain. There are also similarities in the causes and effects of these diseases. State **one** such similarity between Alzheimer's disease and Parkinson's disease. (1 mark)

Description	Marks
Any one of:	
• due to a neurotransmitter deficiency	1
• late onset/age of onset	
• cognitive/memory impairment	
Total	**1**

(b) (i) Using the numbered labels on the diagrams in the box on the right, indicate which neuron would be located in the region of the spinal cord labelled X. (1 mark)

Description	Marks
3	1
Total	**1**

(ii) Describe the structure labelled Y in the diagram. (2 marks)

Description	Marks
Any two of:	
• (nerve) contains fibres of neurons	1–2
• (fibres) both sensory and motor/afferent and efferent/to and from CNS/mixed nerve	
• wrapped in connective tissue	
Total	**2**

(iii) Describe the pathway involved in a spinal reflex which brings about a fast, automatic response following stimulation of a pain receptor. (4 marks)

Description	Marks
Sensory neuron carries impulse to spinal cord	1
Passes through one (or more) synapse in spinal cord/connector neuron	1
Motor neuron carries impulse out of spinal cord	1
Effector receives impulse	1
Total	**4**

Question 32 (continued)

(c) Explain how a nervous impulse can travel from one neuron to the next. (3 marks)

Description	Marks
Calcium ions flow in to pre-synaptic knob/axon endings/exocytosis of vesicles containing neurotransmitter	1
Neurotransmitter diffuses across gap/synapse	1
Neurotransmitter binds to receptors on post-synaptic membrane/dendrite of next neuron	1
Total	**3**

(d) The autonomic and somatic divisions of the peripheral nervous system are both involved in the transmission of nervous impulses from the central nervous system to effectors. However they differ in both structure and function. Provide **two** differences between the autonomic and somatic divisions. (4 marks)

Description		Marks
Any two pairs of:		
Autonomic division	**Somatic division**	1–4
Effectors include heart, smooth muscles and glands	Effectors include skeletal muscles	
(Usually) not under conscious control/involuntary	(Usually) under conscious control/voluntary (and involuntary)	
Sympathetic and parasympathetic fibres to effector/excitatory and inhibitory effects	One fibre to effector/excitatory effect	
Neurotransmitters include acetylcholine and noradrenaline	Neurotransmitter is acetylcholine only	
Two nerve fibres from CNS to effector/synapse at ganglion	One nerve fibre from CNS to effector/no ganglion	
	Total	**4**

Question 33 **(9 marks)**

(a) What type of cells were cloned into plasma cells to produce antibodies in the period labelled A on the graph? (1 mark)

Description	Marks
B cells/B lymphocytes/B	1
Total	**1**

(b) Describe the roles of macrophages in the response to the first vaccine shown in the graph. (3 marks)

Description	Marks
Antigen recognised/detected by macrophages	1
Macrophage presents antigen to B cells/B lymphocytes	1
Macrophages phagocytose/engulf antigen	1
Total	**3**

(c) On the graph, which line (1, 2 or 3) **best** represents the antibody level following the booster injection? Justify your answer. (3 marks)

Description	Marks
Line 1	1
Memory cells present	1
Any one of:	
• faster recognition of antigen	1
• more antibodies produced	
• level of antibodies maintained for longer	
Total	**3**

(d) Following exposure to a virus, patients are sometimes prescribed antiviral medication. Explain how antivirals are thought to work. (1 mark)

Description	Marks
Inhibit viral reproduction/development/replication	1
Total	**1**

(e) Explain how vaccines containing antigens can reduce the incidence of infection in a population. (1 mark)

Description	Marks
Any one of:	
• pathogen removed from system	1
• pathogen destroyed faster	
• less chance of passing on/fewer people affected	
• no host for pathogen	
Total	**1**

Question 34 **(10 marks)**

(a) Which of the fossils A to F is the oldest? Justify your answer. (2 marks)

Description	Marks
D	1
The greater the amount of fluoride ions in the bone (the older it is)	1
Total	**2**

(b) If these fossil bones had been found at different sites, it would not have been possible to determine their relative ages. Explain why. (2 marks)

Description	Marks
The bone absorbs the fluoride ions from its surroundings/ground water surrounding it	1
The amount of fluoride ions varies from place to place/between locations/is specific to a particular area.	1
Total	**2**

(c) (i) Suggest which other relative dating method may have been used to date fossil bones B and E. (1 mark)

Description	Marks
Stratigraphy/principle of superposition	1
Total	**1**

(ii) Provide an explanation for the discrepancy between the use of fluorine dating and the method of dating stated in part (c)(i) to date fossil bones B and E.(1 mark)

Description	Marks
Any one of:	
• one bone buried deeper than other by humans or animals	1
• distortion of the earth's crust/layers turned upside down/geological disturbance	
• error in fluorine dating	
Total	**1**

(d) To determine an actual age of fossil bones B and E, another dating method would need to be used. Name and describe **one** dating method that could be used to determine how old each of these fossil bones is. (4 marks)

Description	Marks
Any four of:	
• absolute dating/Carbon$_{14}$/radiocarbon dating/carbon dating	1–4
• based on the decay of C_{14} to nitrogen	
• half life of 5730 years/takes 5730 years for half of C_{14} to decay	
• determine the amount of C_{14} left in relation to C_{12}	
• date up to 70 000 years old	
Total	**4**

Question 35 **(9 marks)**

(a) Which section of the graph **best** represents the temperature at which annealing occurs? (1 mark)

Description	Marks
C	1
Total	**1**

(b) Why is the temperature required to be so high at section B on the graph? (1 mark)

Description	Marks
Any one of:	
• to denature the DNA strand/separate the double stranded DNA into two single strands	1
• to break the weak hydrogen bonds between complementary bases	
Total	**1**

(c) (i) Describe the role of Taq polymerase in section D on the graph. (2 marks)

Description	Marks
Binds to the primer (DNA template hybrid/combined primer and single DNA strand)	1
Synthesises a new DNA strand/creates a complementary strand	1
Total	**2**

(ii) Explain why Taq polymerase is an appropriate enzyme to use in PCR. (1 mark)

Description	Marks
Is capable of withstanding high temperatures/will not denature during process	1
Total	**1**

(d) Explain how gel electrophoresis works. (4 marks)

Description	Marks
Any four of:	
• DNA pieces are placed at one end of a bed of gel	1–4
• an electric current is passed through the gel/a voltage is applied across the gel	
• DNA is negatively charged so moves through the gel to the positive electrode	
• DNA pieces move through the gel at different speeds/smaller DNA pieces move faster than large ones	
• bands form/pattern form/fingerprint	
Total	**4**

Question 36 **(9 marks)**

(a) Identify **two** variables that were controlled in the experiment. (2 marks)

Description	Marks
Any two of:	
• delivery of the drug and placebo (oral administration)	1–2
• age range of infants	
• daily doses of drug and placebo	
• length of treatment	
Total	**2**

(b) During the experiment, group B received a placebo.

(i) Define 'placebo'. (1 mark)

Description	Marks
Substance without ingredient/has no effect	1
Total	**1**

(ii) Why are placebos usually administered in experiments? (1 mark)

Description	Marks
Any one of:	
• acts as a control/acts as a comparison to experimental group	1
• reduces the effect of psychological influences on the results/ psychological influences the same between groups	
Total	**1**

(c) With reference to the data provided, state **one** conclusion that can be drawn from the experiment. (1 mark)

Description	Marks
Any one of:	
• caffeine reduced the need for a breathing tube (intubation) by one week	1
• caffeine reduced the need for additional oxygen by 1.5 weeks	
Total	**1**

(d) Given this additional data, formulate a new hypothesis that researchers could now be interested in studying. (1 mark)

Description	Marks
Statement including an independent and dependent variable/nil hypothesis/null hypothesis (e.g. caffeine slows weight gain in infants), weight must be dependent variable	1
Total	**1**

(e) (i) A change in concentration of a particular compound is the most important factor in stimulating the breathing reflex. Name this compound. (1 mark)

Description	Marks
Carbon dioxide	1
Total	**1**

(ii) Breathing can be altered voluntarily, allowing individuals to increase or decrease breathing rate or even stop breathing for a short time. What part of the brain voluntarily controls breathing? (1 mark)

Description	Marks
Cerebral cortex/cerebrum	1
Total	**1**

(iii) Why is it important for humans to have voluntary control over breathing rate? (1 mark)

Description	Marks
Protective device/stops water entering lungs when swimming/ prevent unwanted gases entering lungs	1
Total	**1**

Question 37 **(13 marks)**

(a) Identify **one** hormone produced at D. (1 mark)

Description	Marks
Parathyroid hormone/PTH/parathormone	1
Total	**1**

(b) (i) Identify which letter in the diagram indicates the gonads. (1 mark)

Description	Marks
G	1
Total	**1**

(ii) Several hormones are produced by the gonads. Name **one** of these hormones, state the target organ it influences and describe the main effect the hormone has on the body. (3 marks)

Description	Marks
• androgens/testosterone • testes/muscles/bones/brain • stimulates sperm production/growth of skeleton and muscles/ maintains male secondary sexual characteristics	1–3
or	
• oestrogens • uterus/breasts/anterior pituitary/hypothalamus/ovaries • stimulates LH production/maintains female secondary sexual characteristics/repairs uterus lining/inhibits FSH	
or	
• progesterone • uterus/breasts/anterior pituitary/hypothalamus • maintains lining of the uterus/prepares breast tissue for milk production/inhibits LH	
Total	**3**

(c) (i) Explain how the production and release of a hormone from the anterior lobe is controlled by structures A and B. (3 marks)

Description	Marks
Produced in B/anterior pituitary	1
Structure A/hypothalamus controls release/acts as receptor	1
(Structure A) secretes releasing factors (into blood)	1
Total	**3**

(ii) Explain how the production and release of a hormone from the posterior lobe is controlled by structures A and B. (3 marks)

Description	Marks
Produced in A/hypothalamus	1
Stored in B/posterior pituitary	1
Nerve impulse from A/hypothalamus triggers release	1
Total	**3**

(d) Hormones differ from nerves in their mode of action. In relation to the time taken to respond and the duration of a response, how is a hormonal response different from a nervous response? (2 marks)

Description	Marks
Time – slower/longer	1
Duration – longer lasting	1
Total	**2**

Question 38 **(11 marks)**

(a) Name the structure labelled B in the diagram of the kidney nephron shown above. (1 mark)

Description	Marks
Loop of Henle	1
Total	**1**

(b) Describe the processes occurring at region A that would have helped the scientists to retain water. (3 marks)

Description	Marks
Active reabsorption of essential materials/amino acids/glucose (from tubule/filtrate/into blood/capillaries)	1
Osmotic pressure of blood increased	1
Any one of:	
• water moves from tubule/filtrate/into blood/capillaries	1
• by osmosis/from dilute to concentrated solution/from where there is more to less water.	
Total	**3**

(c) Explain how this hormone enables the increase in concentration of urine, thus reducing the amount of dehydration the scientists suffered. (2 marks)

Description	Marks
Increases the permeability of the tubule wall	1
Enabling water to be reabsorbed	1
Total	**2**

(d) Several physiological mechanisms were employed by the bodies of the scientists to maintain their internal body temperature at normal levels despite being in the freezing external temperatures of the mountains. These mechanisms were all controlled by the hypothalamus but transmitted by different methods. Complete the table below, explaining how these physiological mechanisms operate. (5 marks)

Description				Marks
Mechanism	**What happens in freezing conditions?**	**This mechanism is controlled by the hypothalamus and transmitted by**	**How does this help maintain body temperature?**	1–5
Blood vessels	Vasoconstriction of skin arterioles	Autonomic nervous system/sympathetic system/nerves		
Muscles	Skeletal/ voluntary muscles contract rapidly/ shivering occurs		Produces heat	
Metabolic rate		Hormones/endocrine/thyroxine/ TSH/TSHRF/ adrenaline/ sympathetic nervous system/autonomic nervous system		
			Total	**5**

Question 39 **(10 marks)**

(a) Describe **three** characteristics of the footprint that would indicate it had been made by a species of hominin. (3 marks)

Description	Marks
Any three of:	
Deep groove/depression at heel/indicates large heel bone	1–3
Big toes aligned with other toes/non opposable big toe	
Lack of depression at arch/indication of transverse arch	
Relatively large big toe	
Total	**3**

(b) On the basis of tools also found at the site, the archaeologists concluded the footprint belonged to *Homo neanderthalensis*. Describe **two** features of the tools that would provide support for the fossilised footprint belonging to *Homo neanderthalensis*. (2 marks)

Description	Marks
Any two of:	
• stone tools that were notched/toothed/denticulated	1–2
• stone/flakes attached/hafted to wood	
• tools made of other materials (such as ivory/bone/antler)	
• greater variety of tool types	
Total	**2**

(c) The archaeologists continued to excavate at the site and discovered tools attributed to another hominin that they considered to be older than *Homo neanderthalensis*. Describe **two** less-advanced features that these tools would have shown to indicate that they were older than the tools attributed to *Homo neanderthalensis*. (2 marks)

Description	Marks
Any two of:	
• pebble tools	1–2
• flake and core tools	
• hand axe	
• less flaked/notched	
Total	**2**

Question 39 (continued)

(d) As hominins evolved their cranial capacity gradually increased. For each of the three functional areas of the cerebral cortex listed below, explain **one** advantage an increased brain size gave to early *Homo sapiens* to enable them to survive in their environment.

(3 marks)

Description		Marks
Functional area of cerebral cortex	**Advantage**	
Association	• improved memory of food/water sources • improved ability to plan hunts (or other example)	1
Motor	• improved muscle control for hunting/(or other example) improve fine motor skills for tool making	1
Sensory	• improved sensory perception for hunting/ perceiving danger (or other example)	1
	Total	**3**

Section Three: Extended answer **20% (40 Marks)**

Question 40 **(20 marks)**

(a) There are several hormones involved in the maintenance of optimal glucose levels in the blood.

Identify **three** of these hormones, state the specific location where they are produced and explain how they assist in the maintenance of optimal blood glucose levels.

(12 marks)

Description	Marks
Four marks each: one for hormone, one for source, two for regulation. Any three of the following hormones.	
Glucagon	1
Produced by the alpha cells/Islets of Langerhans/pancreatic islets	1
Any two of: • glycogenolysis of glycogen/breakdown of glycogen into glucose in the liver • gluconeogenesis of lipids/breakdown of lipids into glucose/lipolysis in the liver/in adipose tissue • gluconeogenesis of amino acids/breakdown of amino acids into glucose	1–2
or	
Cortisol	1
Produced by the adrenal cortex	1
Any two of: • glycogenolysis of glycogen/breakdown of glycogen to glucose • removal of amino acids from muscle cells • amino acids transported to liver for gluconeogenesis/amino acid to glucose	1–2
or	
Adrenaline/noradrenaline	1
Produced in the adrenal medulla	1
Any two of: • glycogenolysis of glycogen/breakdown of glycogen to glucose • glycogen in muscles is acted on to produce lactic acid/lactic acid is converted to glucose in the liver • increased numbers of insulin receptors on cell surface/Increased sensitivity of insulin receptors	1–2
or	
Insulin	1
Produced by the beta cells/Islets of Langerhans/pancreatic islets	1
Any two of: • glycogenesis of glucose/conversion of glucose to glycogen in liver/muscles • conversion of glucose into lipids in adipose tissue • transport of glucose into cells/acts as a receptor for glucose on cell membranes (for respiration)	1–2
or	
Thyroxine	1
Produced by the thyroid gland	1
Enhances absorption of glucose from the small intestine (into the blood stream)	1
Increases glucose metabolism in cells/reduced blood glucose due to increased respiration	1
Total	**12**

Question 40 (continued)

(b) The inability to maintain optimal blood glucose levels results in the condition called diabetes mellitus. This condition occurs in two different forms known as Type 1 and Type 2.

In what ways are these **two** forms of diabetes mellitus similar and how do they differ?
(8 marks)

<table>
<tr><th colspan="2">Description</th><th>Marks</th></tr>
<tr><td colspan="2">Similarities
Any two of:</td><td></td></tr>
<tr><td colspan="2">• abnormally high blood glucose levels/hyperglycaemia</td><td rowspan="3">1–2</td></tr>
<tr><td colspan="2">• high levels of glucose excreted in urine</td></tr>
<tr><td colspan="2">• complications such as kidney failure/heart disease/stroke/nerve damage/eye problems</td></tr>
<tr><td colspan="2">Differences
Any three of:</td><td></td></tr>
<tr><td>Type 1</td><td>Type 2</td><td rowspan="6">1–6</td></tr>
<tr><td>• usually begins in childhood/ born with it</td><td>• usually adult onset/occurs in people over 45</td></tr>
<tr><td>• a fault in the immune system/ destruction of beta cells/islet cells</td><td>• lifestyle disease/caused by obesity/lack of exercise/high blood pressure/diet high in fat and salt/diet low in fibre/high blood cholesterol/smoking</td></tr>
<tr><td>• inability to produce insulin</td><td>• can produce insulin</td></tr>
<tr><td>• cells are able to respond normally to insulin</td><td>• cells are not able to respond to insulin/cells unable to take up glucose from the blood/insulin resistance</td></tr>
<tr><td>• treatment by injections/ programmable pump for regular supply of insulin</td><td>• treatment by changing lifestyle choices/weight loss/exercise/ monitoring blood glucose levels</td></tr>
<tr><td colspan="2">Total</td><td>8</td></tr>
</table>

Question 41 **(20 marks)**

Skin colour in humans is determined by many pairs of alleles in the genome. It is also greatly influenced by the environment in which a person lives.

(a) Explain how a change in skin colour could be stimulated by the exposure to UV light. (7 marks)

Description	Marks
Any seven of:	
• increased UV light results in darker skin	1–7
• melanin is found in skin cells called melanocytes	
• melanocytes produce melanosomes	
• melanosomes form melanin	
• the amount of melanosomes found in skin can vary	
• UV light stimulates the enzyme tyrosinase	
• more tyrosinase/enzyme activity increases the number of melanosomes/ melanin production	
• the more melanin in skin the darker the colour	
Total	**7**

(b) Many different theories aim to explain how variation in skin colour exists between human populations. Using your knowledge of natural selection and how environmental factors can affect skin colour, explain how light skin may have first evolved from a population of dark-skinned individuals. (7 marks)

Description	Marks
Any seven of:	
• mutation occurs (in alleles controlling skin colour)	1–7
• mutation causes decreased melanin production/a reduction the action of tyrosinase/decreased number of melanosomes in skin	
• variation exists within the population/mostly dark skin people, with some light skinned individuals	
• competition/more individuals living in the population than the resources can sustain	
• selection pressure/incidence of rickets/lack of vitamin D	
• light skinned individuals have a survival advantage/light skinned individuals better suited to the environment	
• light skinned individuals will have better reproductive success than dark skinned individuals/more light skinned offspring produced	
• over many generations increased frequency of alleles producing light skinned individuals	
Total	**7**

Question 41 (continued)

(c) Explain how epigenetic factors could possibly alter gene expression. (6 marks)

Description	Marks
Environmental factor (or relevant example) influences genome	1
Causes (relevant) gene to be switched on or off	1
Methylation	1–2
• unmethylated cytosines/no DNA methylation	
• transcription of genes promoted/ more genes expressed	
or	
• methylated cytosines/DNA methylation occurring	
• transcription of genes inhibited/ less genes expressed	
Histone modification	1–2
• deacetylated histones/ histone modification	
• less DNA exposed/ more tightly coiled	
• transcription of genes inhibited/ less genes expressed	
or	
• acetylated histones/ histone modification	
• exposes more DNA/ less coiling	
• transcription of genes promoted/ more genes expressed	
Total	**6**

Question 42 **(20 marks)**

(a) Archaeologists discovered a fossil of an extinct primate specimen. They concluded that it was one of the most primitive members of the primate order, displaying characteristics much like lemurs or lorises of today.

Given your understanding of primate evolutionary trends, identify **six** characteristics you would expect the primate specimen to display. These six characteristics can include physical features of the fossil remains or characteristics of the primate's past lifestyle. For each of the six characteristics identified, also describe the trend toward the most advanced primates, such as apes and humans. (12 marks)

Description			**Marks**
Any six features of: (must match points)			
Feature	**Primitive fossil specimen**	**Advanced primates**	
Cerebral cortex/skull	Small size/limited number of convolutions/makes up smaller proportion of the brain	Increased size/ increased number of convolutions/makes up larger proportion of the brain	1–2
Smell/Olfactory	Good sense of smell/ long snout/scent markings/arge proportion of cerebrum devoted to smell	Reduced sense of smell/reduce size of snout/decreased proportion of cerebrum devoted to smell	1–2
Vision/Optical	Relatively poor vision/ eyes more on the side of head/smaller proportion of cerebrum devoted to vision	Increased efficiency of vision/more forward facing eyes/improved stereoscopic vision/ increased proportion of cerebrum devoted to vision	1–2
Gestational time	Short length of time	Increased length of time	1–2
Parental care	Short length of time offspring dependent on parent/early development of sexual maturity	Increased length of time offspring dependent on parent/ later development of sexual maturity	1–2
Digits	Limited mobility/ limited opposability	Increased mobility/ increased opposability/digits able to move independently of each other	1–2
Claws/nails	Claws present	Nails present	1–2
Teeth shape	4 cusped molar/small canines	5 cusped molar/larger canines	1–2
Dental arrangements	36 teeth	32 teeth/reduced number of teeth	1–2
		Total	**12**

(b) Around 5-6 million years ago, environmental conditions in Africa changed. These changes are believed to have contributed to the appearance of the first hominin individuals. Outline the environmental changes that occurred in Africa, identify the important hominin characteristic that evolved as a result of these changes and explain how this new characteristic was advantageous for hominins in the new environment.

(8 marks)

Description	Marks
Any two of:	
• shift from dense forest/less trees • open grassland/more open space/savannah • cooler/drier climate	1–2
Bipedal/erect stance favoured	1
Any five of:	
Best adapted to the new environment because it	
• leaves hands free for carrying food/tool use/tool manufacture/carry offspring • allows for higher reach for collecting food • improved cooling as sun strikes smaller proportion of the body • improved cooling from the wind reaching the upper body/improved evaporative cooling • increased range of vision/seeing greater distance better for detecting predators • increased size/height better for deterring predators • more energy efficient method of locomotion (travelling-efficiency hypothesis) • can walk/hunt in deeper waters (aquatic-ape hypothesis)	1–5
Total	**8**

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