



# **HUMAN BIOLOGY**

## **ATAR course examination 2022**

### **Marking key**

Marking keys are an explicit statement about what the examining panel expect of candidates when they respond to particular examination items. They help ensure a consistent interpretation of the criteria that guide the awarding of marks.

## Section One: Multiple-choice

30% (30 Marks)

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

## Section Two: Short answer

50% (99 Marks)

## Question 31

(18 marks)

- (a) Identify the type of neuron shown in the diagram. (1 mark)

Description	Marks
Motor/efferent/multipolar	1
<b>Total</b>	<b>1</b>

- (b) List **two** features of the neuron that can be used to distinguish it from other types of neurons found in the human body. (2 marks)

Description	Marks
Any two of	
<ul style="list-style-type: none"> <li>• long singular axon</li> <li>• multipolar</li> <li>• located in ventral root of spinal cord</li> <li>• carries nerve impulses from CNS/towards effectors</li> <li>• cell body located at end of neuron</li> </ul>	1–2
<b>Total</b>	<b>2</b>

- (c) State the function of the structure labelled as X. (1 mark)

Description	Marks
Any one of	
<ul style="list-style-type: none"> <li>• receives messages/impulses from receptor/other neurons</li> <li>• carry messages/impulses into/towards the cell body</li> </ul>	1
<b>Total</b>	<b>1</b>

- (d) Contrast the transmission of nerve impulses in myelinated and unmyelinated neurons. (4 marks)

Description	Marks
Myelinated – any two of	
<ul style="list-style-type: none"> <li>• depolarization occurs in nodes of Ranvier</li> <li>• action potential jumps from node to node/saltatory conduction</li> <li>• impulse moves faster</li> </ul>	1–2
Unmyelinated – any two of	
<ul style="list-style-type: none"> <li>• depolarization occurs along length of axon</li> <li>• action potential must travel full axon length/does not jump</li> <li>• nerve impulse moves slower</li> </ul>	1–2
<b>Total</b>	<b>4</b>

**Question 31** (continued)

- (e) (i) Describe the role of sodium channels found within a neuron's cell membrane. (2 marks)

Description	Marks
allow sodium ions to diffuse (rapidly) into axon	1
this brings about depolarisation/action potentials generated	1
<b>Total</b>	<b>2</b>

- (ii) If a local anaesthetic works by blocking the sodium channels, describe how this would affect the conduction of an action potential. (2 marks)

Description	Marks
sodium ions can no longer enter the axon	1
there is no action potential/no depolarisation of membrane/no nerve impulse	1
<b>Total</b>	<b>2</b>

- (f) Explain how this would lead to pain signals from affected parts of the body not reaching the brain. (6 marks)

Description	Marks
calcium ions cannot diffuse into the synaptic knob	1
prevents (synaptic) vesicles from fusing with presynaptic membrane	1
no neurotransmitter is released	1
no influx of sodium ions into post-synaptic neuron	1
no action potential is generated on next neuron	1
therefore pain signal is not sent along sensory neuron to brain	1
<b>Total</b>	<b>6</b>

## Question 32

(21 marks)

- (a) Identify the names of the **two** types of mammalian teeth that are shown in the teeth profile part of the diagram. (2 marks)

Description	Marks
canines	1
premolars/molar	1
<b>Total</b>	<b>2</b>

- (b) State the letter of the tooth profile that matches correctly the skull as shown in the diagram. (2 marks)

Description	Marks
skull 2 – P	1
skull 4 – O	1
<b>Total</b>	<b>2</b>

- (c) Using the diagram above, identify **three** hominid evolutionary trends shown in the jaws and teeth. (3 marks)

Description	Marks
Any three of	
<ul style="list-style-type: none"> <li>• reduced size of canines/molars/teeth</li> <li>• loss of diastema</li> <li>• teeth become more evenly sized to one another</li> <li>• flatter face/reduced prognathism/smaller jaw</li> </ul>	1–3
<b>Total</b>	<b>3</b>

- (d) Explain how an index fossil can be used to date another fossil. (3 marks)

Description	Marks
index fossils have a known date/age range	1
due to widespread but limited time span they exist	1
if found with other fossils, age can be correlated	1
<b>Total</b>	<b>3</b>

- (e) '*Homo sapiens* could, in a future setting, be an excellent example of an index fossil. All other known hominin species would be poor index fossils.' Justify this statement. (3 marks)

Description	Marks
all hominins have had a limited time on Earth	1
but they were not all widespread across the Earth	1
only <i>Homo sapiens</i> are found on all continents/are widespread	1
<b>Total</b>	<b>3</b>

## Question 32 (continued)

- (f) (i) One reason why gaps in the fossil record exist is that conditions for fossil formation are very specific. Complete the table below, describing each specific condition needed for fossil formation. (4 marks)

Description	Marks
Soil type – Alkaline with low oxygen levels	1
Specimen to be fossilised – Contains hard (solid) parts/bone/teeth	1
Micro-organisms – Not present/protected from decay	1
Exposure to atmosphere – Covered quickly at death/protected by sediment	1
<b>Total</b>	<b>4</b>

- (ii) Apart from the conditions listed in part (f)(i), describe **two** other reasons why gaps in the fossil record exist. (4 marks)

Description	Marks
Any two of (1 mark for the condition and 1 mark for describing it)	
<ul style="list-style-type: none"> <li>• fossils can be buried too deep</li> <li>• making them too hard to find</li> </ul>	1–4
<ul style="list-style-type: none"> <li>• fossil can be destroyed</li> <li>• through human activity/geological processes/weathering and erosion</li> </ul>	
<ul style="list-style-type: none"> <li>• fossils need to be left undisturbed for a long time/not attacked by scavengers/disturbed by geological process</li> <li>• to allow time for the fossilisation process to take place</li> </ul>	
<ul style="list-style-type: none"> <li>• fossil may not be discovered</li> <li>• people not looking in right locations/not being recognised</li> </ul>	
<b>Total</b>	<b>4</b>

## Question 33

(9 marks)

- (a) State **one** specific location in the body where pain receptors are found. (1 mark)

Description	Marks
skin/cornea/mucosa/muscles/joints/bladder/visceral organs	1
<b>Total</b>	<b>1</b>

- (b) Distinguish a gene mutation from a chromosomal mutation. (2 marks)

Description	Marks
gene mutations only affect one gene (loci)	1
chromosomal mutations affects more than one gene/part of a chromosome/whole chromosome	1
<b>Total</b>	<b>2</b>

- (c) The mutation to the SCN9A gene is classified as a substitution mutation. Identify which of the three mutations shown (X, Y or Z) is a substitution mutation and state how the substitution mutation alters the genome. (2 marks)

Description	Marks
X	1
Substitution is a type of mutation where one base pair is replaced by a different base pair.	1
<b>Total</b>	<b>2</b>

- (d) To examine the SCN9A mutation in patients, DNA sequencing needs to be carried out. For the following bacterial enzymes, state the biotechnological technique they are used in and describe their role in that technique. (4 marks)

Description	Marks
<b>Restriction enzymes</b>	
gel electrophoresis	1
cuts DNA into fragments	1
<b>DNA polymerase</b>	
PCR	1
makes repeated copies of the DNA	1
<b>Total</b>	<b>4</b>

## Question 34

(22 marks)

(a) State a hypothesis for this investigation.

(2 marks)

Description	Marks
Hypothesis in an appropriate format (e.g. must not be a question, must not have an "and", be precisely written, testable statement).	1
Hypothesis contrasts increasing the type of antibiotic/dosage with the number of bacterial colonies.	1
<b>Total</b>	<b>2</b>
Answer could include:  Trishillin antibiotic will reduce the numbers of golden staph bacteria colonies more than Vancomycin antibiotic.	

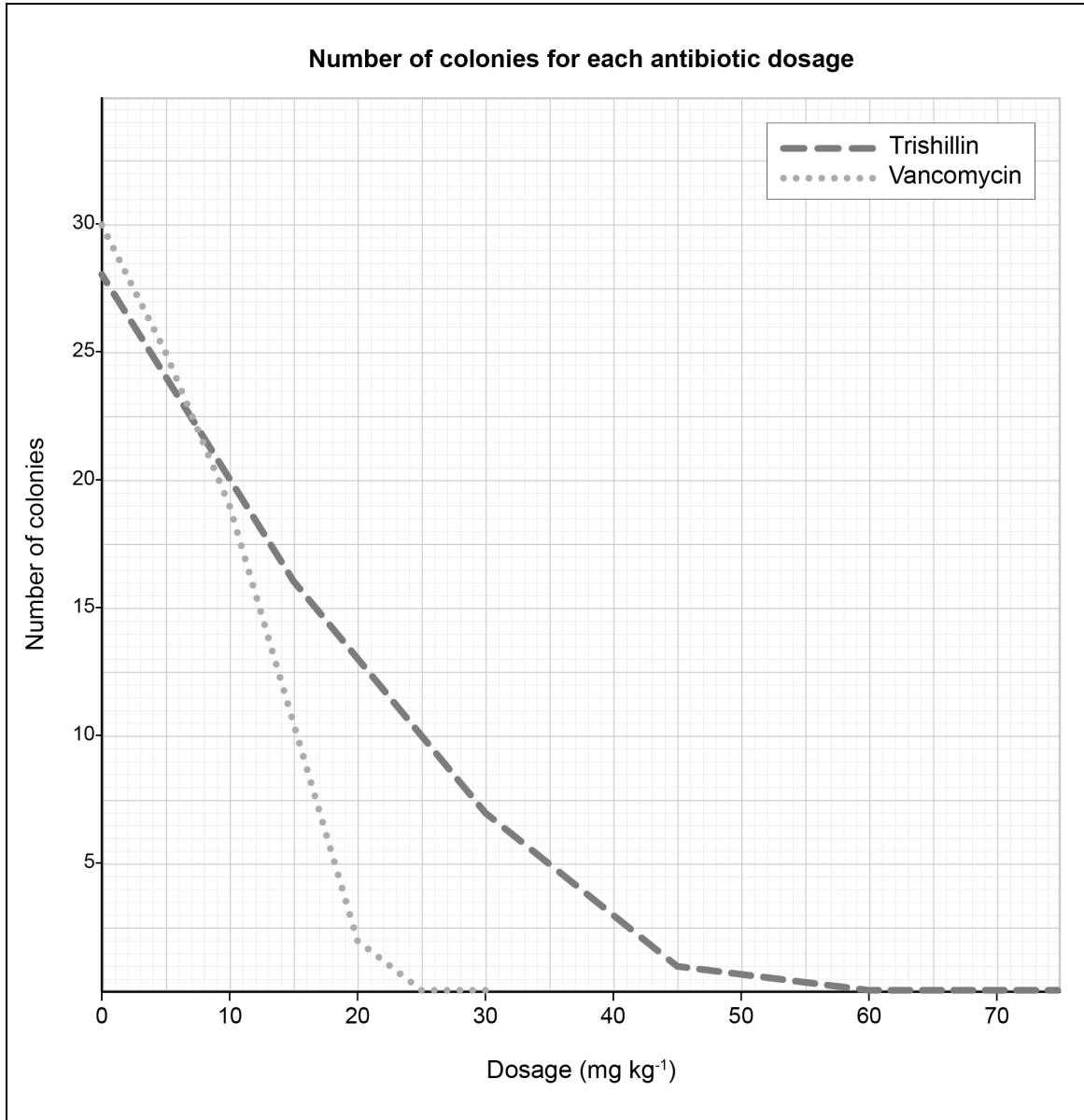
(b) Determine whether the investigation had a control. Justify your response.

(3 marks)

Description	Marks
Yes	1
Any one of (1 mark for identifying the control and 1 mark for justification)	
<ul style="list-style-type: none"> <li>• vancomycin/original/used treatment</li> <li>• gives data/to compare the action of Trishillin/new antibiotic</li> </ul>	1-2
<ul style="list-style-type: none"> <li>• zero dose (for each treatment)</li> <li>• gives data to compare the action with no dose and the treatment</li> </ul>	
<b>Total</b>	<b>3</b>



(c) On the grid below, graph the number of colonies for each antibiotic dosage. (5 marks)



Description	Marks
Title appropriate with both independent and dependent variables included (independent = type of dosage; dependent = number of colonies).	1
Correctly constructs axes using appropriate scale.	1
Correctly plots points and joins points to form a line.	1
Identifies lines using key/labels.	1
Labelling of axes with correct name and unit (dosage on X axis, number of colonies on Y axis).	1
<b>Total</b>	<b>5</b>

(d) Using your graph, estimate the number of colonies you would expect if a 15 mg kg<sup>-1</sup> dosage of Vancomycin had been tested. (1 mark)

Description	Marks
10 (+ - 2)	1
<b>Total</b>	<b>1</b>

**Question 34** (continued)

- (e) Explain why the researchers cultured the Petri dishes under identical conditions except for the variation in antibiotics. (2 marks)

Description	Marks
controlled variables	1
no other factors could influence the dependent variable/increase validity	1
<b>Total</b>	<b>2</b>

- (f) Explain why the researchers used 100 Petri dishes for each antibiotic concentration rather than 10. (2 marks)

Description	Marks
increases sample size/acts as replication/acts as repetition	1
reduces effects of biological variation/experimental error/increase reliability	1
<b>Total</b>	<b>2</b>

- (g) Antibiotics are divided into two types on the basis of their mode of action. These are known as bactericidal and bacteriostatic. Explain how **each** type of antibiotic acts on bacterial cells. (4 marks)

Description	Marks
<b>Bactericidal</b>	
change the structure of the cell wall/membrane/disrupt action of essential enzymes/disrupt metabolic pathways	1
destroy the pathogen	1
<b>Bacteriostatic</b>	
prevent reproduction/inhibit growth	1
disrupting protein synthesis	1
<b>Total</b>	<b>2</b>

- (h) Researchers are also interested in the possibility of producing a synthetic vaccine to treat golden staph.

- (i) Identify a biotechnological technique that could be used to create a synthetic vaccine. (1 mark)

Description	Marks
recombinant DNA	1
<b>Total</b>	<b>1</b>

- (ii) Explain the role of a transgenic organism, or genetically-modified organism, in the process identified in part (h)(i). (2 marks)

Description	Marks
<b>Any two of</b>	
<ul style="list-style-type: none"> <li>• plasmids with the inserted gene of interest</li> <li>• to produce the desired protein/vaccine</li> <li>• in large quantities/quickly/cheaply</li> </ul>	1–2
<b>Total</b>	<b>2</b>

## Question 35

(16 marks)

- (a) (i) Complete the table below by identifying **two** different effectors, the physiological mechanism that each would employ when operating in the hot conditions and how these mechanisms help to maintain body temperature. (8 marks)

	Description		Marks
	Effector One	Effector Two	
Name of the effector	Skin Arterioles (1)	Sweat glands (1)	1–2
Physiological mechanism for hot conditions	Vasodilation (1)	(Increased) sweating (1)	1–2
How the mechanism helps to maintain body temperature	Vasodilation by bringing blood close to the surface (1). Heat can then be removed through radiation/conduction/convection (1).	Sweating increases water/moisture on the skin (1). Heat drawn from body to evaporate water on skin (1).	1–4
<b>Total</b>			<b>8</b>

- (ii) Identify **two** behavioural mechanisms that a person could use to maintain body temperature in these hot conditions. (2 marks)

Description	Marks
Any two of	
<ul style="list-style-type: none"> <li>• remove clothing</li> <li>• stay still/reduce activity</li> <li>• spread body out</li> <li>• avoid heat sources/stay in cool place</li> <li>• go for a swim/cold shower</li> </ul>	1–2
<b>Total</b>	<b>2</b>

**Question 35** (continued)

- (b) (i) Complete the flow diagram below to show how blood glucose would be regulated during the eight hours of normal eating during the diet. (2 marks)

Description	Marks
Receptor – Chemoreceptors/Beta cells (of pancreas)	1
Modulator – Beta cells (of pancreas)	1
<b>Total</b>	<b>2</b>

- (ii) During the 16-hour fasting stage, which hormone associated with blood glucose regulation would be present in high concentrations? (1 mark)

Description	Marks
glucagon	1
<b>Total</b>	<b>1</b>

- (iii) Using your understanding of blood glucose regulation, propose how this type of dieting could help to achieve weight loss. (3 marks)

Description	Marks
more time is spent with high levels of glucagon (than insulin)	1
Any two of	
<ul style="list-style-type: none"> <li>• means more time spent converting glycogen/fats/amino acids to glucose</li> <li>• less time spent storing glucose/converting to fat</li> <li>• less time eating means overall less kilojoules can be consumed</li> </ul>	1–2
<b>Total</b>	<b>3</b>

## Question 36

(13 marks)

- (a) (i) Identify **one** other vestigial organ of the human body. (1 mark)

Description	Marks
appendix/male nipples/muscles to move ears/nictitating membrane/pointed canines/wisdom teeth/hair on body	1
<b>Total</b>	<b>1</b>
Accept other relevant answers.	

- (ii) Explain how vestigial organs provide evidence for evolution. (3 marks)

Description	Marks
structures that have a benefit/normal function in some species	1
present but not functional in other species	1
indicates shared common ancestry/at one point both species shared an ancestor who had the structure	1
<b>Total</b>	<b>3</b>

- (b) If colour blindness did provide a survival advantage, using the theory of natural selection, explain how colour blindness would have been maintained in early human populations. (5 marks)

Description	Marks
some individuals possess the colour blindness trait/allele for colour blindness present in population/variation in the population	1
competition exists in population/struggle to survive/limited resources present	1
those with colour blindness are more suited to the environment/have better vision so able to see predators better	1
more likely to survive to reproduce/more likely to pass alleles onto offspring	1
allele maintained/increased in gene pool	1
<b>Total</b>	<b>5</b>

**Question 36** (continued)

- (c) (i) If colour blindness did provide a survival advantage to this population, identify the name of the process that would provide the best explanation for the change in the population over time. (1 mark)

Description	Marks
(Random) genetic drift	1
<b>Total</b>	<b>1</b>

- (ii) Justify your response to part (c)(i). (3 marks)

Description	Marks
Any three of	
<ul style="list-style-type: none"><li>• due to small size more likely to occur</li><li>• no gene flow evident with other populations</li><li>• must be a chance event</li><li>• because if it does have a survive advantage it would be selected for/it would be maintained or increase in the population</li></ul>	1–3
<b>Total</b>	<b>3</b>

## Section Three: Extended answer

20% (40 Marks)

## Unit 3

## Question 37

(20 marks)

- (a) Using the information above, identify the part of the brain damaged in both patients (X and Y), describe the role of these parts in normal body functioning and describe the effects damage to these structures would have on both patients. (12 marks)

Description	Marks
<b>Patient X</b>	
Affected part – Anterior Pituitary	1
Normal role – any two of <ul style="list-style-type: none"> <li>• produces hormones</li> <li>• releases hormones</li> <li>• maintain homeostasis</li> </ul>	1–2
Possible effects of damage – any three of <ul style="list-style-type: none"> <li>• hypothyroidism/reduced thyroxine</li> <li>• fatigue/reduced energy levels/weakness/lethargy/reduced metabolic rate</li> <li>• loss of appetite</li> <li>• slow heart rate</li> <li>• feeling cold (especially in hands and feet)</li> <li>• increase weight/fluid retention</li> </ul>	1–3
<b>Subtotal</b>	<b>6</b>
<b>Patient Y</b>	
Affected part – Cerebellum	1
Normal role – any two of <ul style="list-style-type: none"> <li>• coordination of voluntary motor movement</li> <li>• balance/equilibrium/posture</li> <li>• muscle tone</li> </ul>	1–2
Possible effects of damage – any three of <ul style="list-style-type: none"> <li>• loss of coordination of motor movement</li> <li>• the inability to judge distance and when to stop</li> <li>• the inability to perform rapid alternating movements</li> <li>• movement tremors</li> <li>• staggering, wide based walking</li> <li>• tendency toward falling</li> <li>• weak muscles</li> <li>• slurred speech</li> <li>• abnormal eye movements</li> </ul>	1–3
<b>Subtotal</b>	<b>6</b>
<b>Total</b>	<b>12</b>

**Question 37** (continued)

- (b) Describe how the hypothalamus and pituitary work together to achieve their main function. (8 marks)

Description	Marks
<b>Posterior pituitary</b>	
Hormones are produced (in cell bodies located) in the hypothalamus/not produced by pituitary.	1
Hormones are transported down the axons/neurosecretory cells.	1
Hormones stored in posterior lobe.	1
Released via nervous stimulation.	1
<b>Subtotal</b>	<b>4</b>
<b>Anterior pituitary</b>	
Hormones produced in anterior lobe.	1
Inhibiting and releasing factors secreted by hypothalamus determine the release of hormones.	1
Blood vessels (hypothalamic-hypophyseal portal system) connect hypothalamus with the anterior lobe/travels in the blood.	1
Released via chemical/hormonal stimulation.	1
<b>Subtotal</b>	<b>4</b>
<b>Total</b>	<b>8</b>



## Question 38

(20 marks)

- (a) Identify and describe **four** external defence mechanisms found in the human body that could help prevent the entry of the mumps pathogen. (8 marks)

Description	Marks
Any four of (1 mark for identifying and 1 mark for describing)	
<ul style="list-style-type: none"> <li>skin</li> <li>impervious barrier to block pathogen entry</li> </ul>	1–8
<ul style="list-style-type: none"> <li>good/friendly/beneficial bacteria on skin/in respiratory or digestive system</li> <li>destroy the pathogen/inhibits growth of pathogen</li> </ul>	
<ul style="list-style-type: none"> <li>mucus/cilia in respiratory tract</li> <li>trap pathogen and push out of body</li> </ul>	
<ul style="list-style-type: none"> <li>lysozyme enzyme in tears/saliva/mucous</li> <li>destroy the pathogen</li> </ul>	
<ul style="list-style-type: none"> <li>stomach acid</li> <li>destroy the pathogen/inhibits growth of pathogen</li> </ul>	
<ul style="list-style-type: none"> <li>tears from the eye</li> <li>flush pathogen from eye</li> </ul>	
<ul style="list-style-type: none"> <li>eyelashes/blinking action of the eye</li> <li>block entry of pathogen</li> </ul>	
<b>Total</b>	
Note: Answers can include skin, respiratory and digestive system, eyes but not the ear, urine flushing or vaginal secretions.	

- (b) Immunisation against mumps can be achieved with vaccination. Distinguish between the terms 'immunisation' and 'vaccination'. Explain how vaccines provide immunity to pathogens and outline **four** different types of vaccines available. (12 marks)

Description	Marks
Distinction between immunisation and vaccination	
Immunisation involves preparing the immune system to respond to pathogens/becoming immune to a pathogen.	1
Vaccination is the artificial introduction of pathogens or their antigens so that the body can make antibodies to that pathogen/cause an immune response.	1
<b>Subtotal</b>	<b>2</b>
How vaccines work – any six of	
<ul style="list-style-type: none"> <li>vaccines contain weakened or inactive parts of a particular pathogen (antigen)</li> <li>body manufactures its own antibodies (to combat the antigen)</li> <li>also manufactures memory cells</li> <li>memory cells remain in the body for a long period of time</li> <li>when exposed/infected with pathogen are triggered memory cells</li> <li>produces a faster/larger immune response</li> <li>patients should now not experience illness/experience less severe illness</li> </ul>	1–6
<b>Subtotal</b>	<b>6</b>
Types of vaccines – any four of	
<ul style="list-style-type: none"> <li>live attenuated vaccines contain pathogens of reduced virulence/reduced ability to produce disease symptoms</li> <li>inactivated (killed) vaccines contain an inactivated or dead pathogen</li> <li>toxoid vaccines contain the inactive disease causing toxin of a pathogen</li> <li>subunit vaccines are when only part of a pathogen (isolated protein) is administered</li> <li>conjugate vaccines contain pieces of bacterial coat including the carrier protein combined together</li> <li>recombinant vaccines are genetically engineered vaccines where a virus protein is inserted into another virus</li> </ul>	1–4
<b>Subtotal</b>	<b>4</b>
<b>Total</b>	<b>12</b>

## Unit 4

## Question 39

(20 marks)

- (a) Describe how the features of *Homo naledi* shown above support the idea that this hominin was both bipedal and arboreal. (12 marks)

Description	Marks
<b>Arboreal</b>	
Evidence from images – any four of <ul style="list-style-type: none"> <li>• short clavicle</li> <li>• high shoulder blades</li> <li>• longer arms/smaller arm to leg ratio</li> <li>• long, curved fingers</li> <li>• long thumbs/prehensile</li> </ul>	1–4
Arms/shoulder adapted for swinging in the trees/circular arms movements/flexibility of arms to rotate through trees.	1
Hands adapted to grip branches/hang from branches. Note: not adapted for brachiation.	1
<b>Subtotal</b>	<b>6</b>
<b>Bipedal – any three of</b>	
<ul style="list-style-type: none"> <li>• long legs</li> <li>• allows for striding gait</li> </ul>	1–6
<ul style="list-style-type: none"> <li>• medial/lateral condyles of knee joint (femur) are large</li> <li>• allows for stability/weight-bearing during walking</li> </ul>	
<ul style="list-style-type: none"> <li>• wide pelvis/carrying angle present</li> <li>• allows for balance/stability</li> </ul>	
<ul style="list-style-type: none"> <li>• robust heel/calcaneus/transverse and longitudinal arches of the feet/non-opposable big toe/aligned big toes</li> <li>• allows for stability/weight-bearing/propulsion</li> </ul>	
<b>Subtotal</b>	<b>6</b>
<b>Total</b>	<b>12</b>

- (b) Explain the relationship between bipedalism, increasing cranial capacity and tool use seen in the hominin group. (8 marks)

Description	Marks
<b>Any eight of</b>	
<ul style="list-style-type: none"> <li>• bipedalism freed hands to carry infants, tools and food</li> <li>• manufacture of tools requires mental dexterity/problem-solving abilities</li> <li>• tools became more complex in their size, manufacture and use</li> <li>• using efficient tools meant better ability to hunt for food (meat)</li> <li>• increase in protein provide energy required to support a larger brain</li> <li>• a larger brain may have contributed to more cooperation and communication</li> <li>• bipedalism may have led to overall behavioural changes in hominids</li> <li>• behavioural changes may have impacted on cranial development/increase in frontal lobe size</li> <li>• speech and language evolved due to increase in cranial capacity</li> </ul>	1–8
<b>Total</b>	<b>8</b>

## Question 40

(20 marks)

- (a) Identify the tool culture and the name of the hominin that produced the tool. Describe how the tool would have been manufactured. (6 marks)

Description	Marks
<b>Tool culture</b>	
Mousterian	1
<i>Homo neanderthalensis</i>	1
<b>Subtotal</b>	<b>2</b>
<b>Manufacture</b>	
made of stone	1
starts with a large core/block of stone	1
large oval flakes struck from worked cores/percussion method/Levallois technique	1
edges trimmed by flaking off pieces around the outline of the flake	1
<b>Subtotal</b>	<b>4</b>
<b>Total</b>	<b>6</b>

- (b) Parts of a fossilised skull and jaw were extracted from the site in the rock stratum directly below the artefact. Identify and describe the techniques that could be used to give this fossil both a relative and an absolute date. (9 marks)

Description	Marks
<b>Relative</b>	
Stratigraphy	1
study of rock layers on site or from photographs	1
principle of superposition/layers at top older than layers at the bottom	1
if fossil found lower than stone tool/artefact then it is older	1
<b>Subtotal</b>	<b>4</b>
<b>Absolute</b>	
<ul style="list-style-type: none"> <li>• Carbon-14 dating</li> <li>• radiation produced from sample would be measured</li> <li>• a ratio of carbon-12 to carbon-14 would be estimated</li> <li>• using that half-life of carbon-14 is 5730 years</li> <li>• actual age would be calculated</li> </ul> or <ul style="list-style-type: none"> <li>• Potassium-argon dating</li> <li>• radiation produced from sample would be measured</li> <li>• potassium-40 to argon-40/argon-40 and calcium-40 in the rock</li> <li>• 1.25 – 1.3 billion years</li> <li>• actual age would be calculated</li> </ul>	1–5
<b>Subtotal</b>	<b>5</b>
<b>Total</b>	<b>9</b>

**Question 40** (continued)

- (c) Outline **five** features the paleontologist would be looking for in the skull if they assumed the fossil belonged to the hominin that manufactured the tool shown in the photograph.  
(5 marks)

Description	Marks
Any five of	
<ul style="list-style-type: none"><li>• cranial capacity around 1400 cc</li><li>• long and low brain case</li><li>• receding/sloping forehead</li><li>• heavy brow ridges</li><li>• occipital bun present</li><li>• depression (the suprainiac fossa) at back of skull</li><li>• no chin</li><li>• swept back cheek bones/flared zygomatic arch</li><li>• more prognathic jaw than modern man</li></ul>	1–5
<b>Total</b>	<b>5</b>

## ACKNOWLEDGEMENTS

- Question 37(a)** Dot points 10–21 adapted from: *Cerebellum* [Definition]. (n.d.). Retrieved July, 2022, from <https://www.health.qld.gov.au/abios/asp/glossary>
- Question 38(b)** Dot points 1–7 information from: World Health Organization. (2020). *How do Vaccines Work?* Retrieved July, 2022, from <https://www.who.int/news-room/feature-stories/detail/how-do-vaccines-work>

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