2025/8301
Web version of 2024/75134

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

ATAR course examination, 2024

Question/Answer booklet

HUMAN BIOLOGY

Place one of your candidate identification labels in this box.

Ensure the label is straight and within the lines of this box.

WA student number: In figures

In words

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time: three hours

Number of additional answer booklets used (if applicable):

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer booklet
Multiple-choice answer sheet

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: up to three calculators, which do not have the capacity to create or store programmes or text, are permitted in this ATAR course examination

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of examination
Section One Multiple-choice	30	30	40	30	30
Section Two Short answer	6	6	90	106	50
Section Three Extended answer Unit 3	2	1	50	20	20
Unit 4	2	1		20	
				Total	**100**

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2024: Part II Examinations*. Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

   Section One: Answer all questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

   Section Two: Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens. Wherever possible, confine your answers to the line spaces provided.

   Section Three: Consists of two parts each with two questions. You must answer one question from each part. Tick the box next to the question you are answering. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.

3. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.

4. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

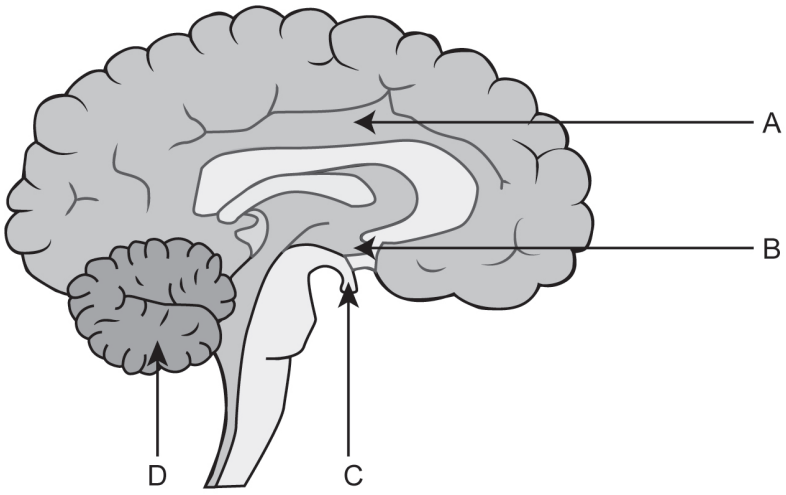
See next page

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

This section has **30** questions. Answer **all** questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 40 minutes.

Questions 1 and 2 refer to the diagram shown below.



1. Which of the following identifies correctly the structures of the brain?

	A	C	D
(a)	cerebellum	pituitary gland	cerebrum
(b)	cerebellum	hypothalamus	cerebrum
(c)	cerebrum	hypothalamus	cerebellum
(d)	cerebrum	pituitary gland	cerebellum

2. Specific parts of the brain control the following functions:

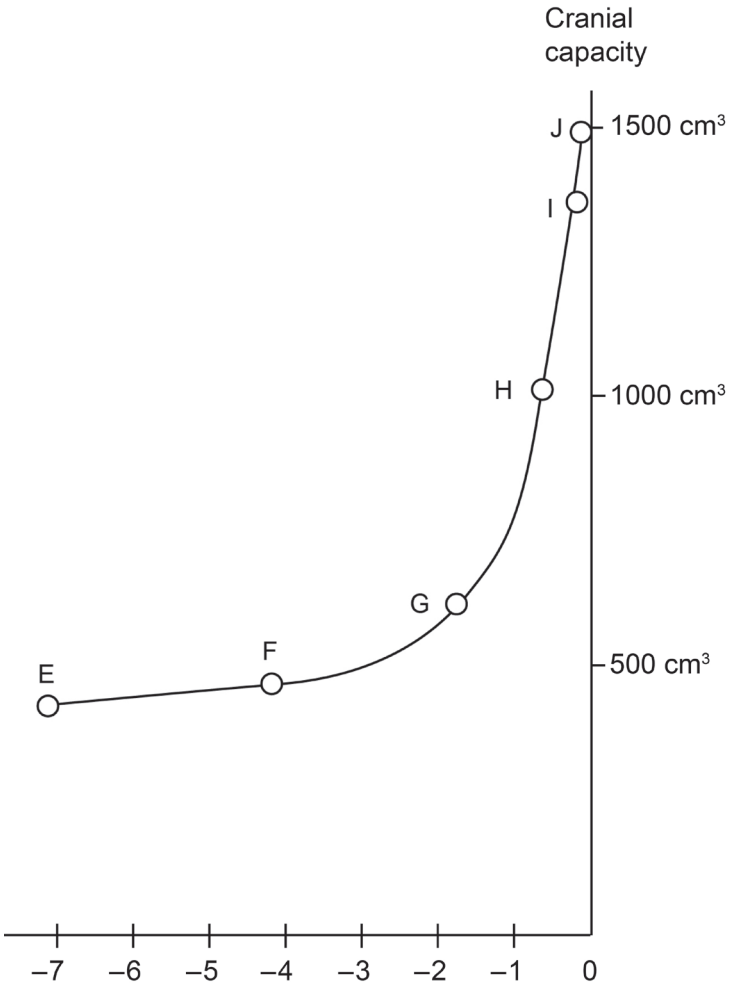
I. breathing rate
II. memory
III. body temperature
IV. sleep cycles

Which of the above functions are controlled by Structure B?

(a) I and II only
(b) II and III only
(c) III and IV only
(d) II, III and IV only

See next page

Questions 3, 4 and 5 refer to the graph shown below.



3. A student constructed the above graph to represent the cranial capacity of different hominin skulls.

Which of the following would be the **best** title for the graph?

(a) Variations in the cranial capacity of six hominin species
(b) Cranial capacity and skull differences of species in the Homo genus
(c) Cranial capacity versus millions of years ago
(d) Changes to the skull over time

4. The student did not receive full marks for the construction of the graph. Which mark did they miss?

(a) poor plotting of the data
(b) error in axis labelling
(c) incorrect graph type
(d) error in scale

See next page

5. Which of the following identifies correctly the skulls indicated by the letters on the graph?

	F	H	I	J
(a)	*Homo erectus*	*Homo habilis*	*Homo sapiens*	*Homo neanderthalensis*
(b)	*Homo habilis*	*Homo erectus*	*Homo neanderthalensis*	*Homo sapiens*
(c)	*Homo habilis*	*Australopithecus africanus*	*Homo neanderthalensis*	*Homo sapiens*
(d)	*Australopithecus africanus*	*Homo erectus*	*Homo sapiens*	*Homo neanderthalensis*

6. The half-life of an isotope of potassium-40 is 1.25 billion years. After 3.75 billion years you would expect

(a) half the original amount of potassium-40 to be present.
(b) one quarter of the original amount of potassium-40 to be present.
(c) one eighth of the original amount of potassium-40 to be present.
(d) all of the original potassium-40 to have formed argon-40.

7. Parkinson's disease can potentially be treated using cell replacement therapy. The purpose of using this therapy would be to replace the cells that

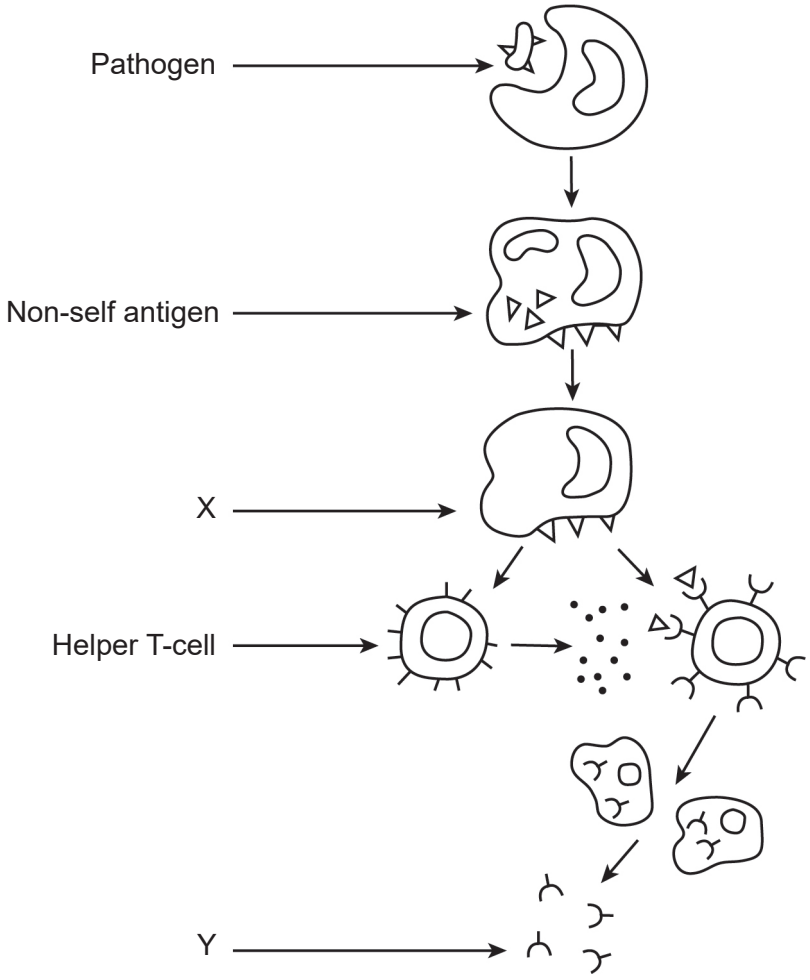
(a) would normally function within the cerebral cortex.
(b) would normally function within the cerebellum.
(c) produce dopamine in the brain.
(d) produce noradrenaline in the brain.

8. A person felt an itch on their left arm and used their right hand to scratch it. Which of the following **best** describes the pathway of this message in the nervous system?

(a) afferent → peripheral nervous system → efferent via autonomic neurons
(b) efferent → central nervous system → afferent via somatic neurons
(c) afferent → central nervous system → efferent via somatic neurons
(d) efferent → peripheral nervous system → afferent via autonomic neurons

See next page

Questions 9 and 10 refer to the diagram shown below.



9. The cell labelled X in the diagram is a

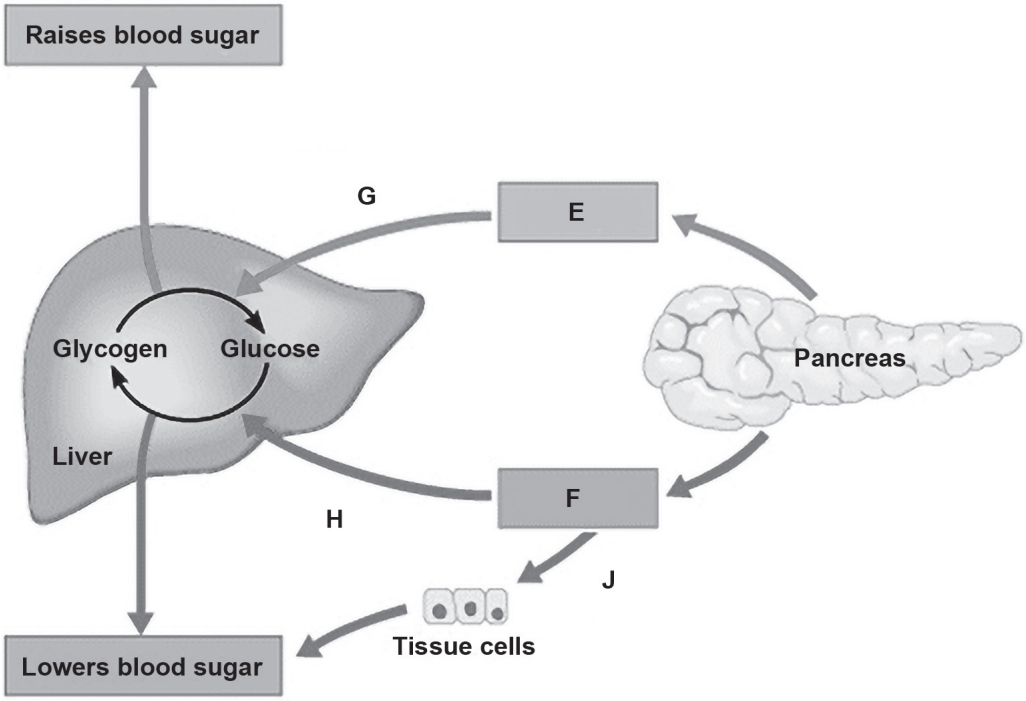
(a) B-cell.
(b) macrophage.
(c) antibody.
(d) thrombocyte.

10. What is the role in the immune response of the structures labelled Y? They

(a) attract killer T-cells to the site of infection.
(b) stimulate B-cells to undergo rapid cell division.
(c) stimulate helper T-cells to release cytokines.
(d) combine with specific antigens to inactivate them.

See next page

Questions 11, 12 and 13 refer to the diagram shown below.



11. Which of the following identifies correctly the hormones labelled E and F and the cells that produce them?

	E	E is produced by these cells	F	F is produced by these cells
(a)	glucagon	alpha cells	insulin	beta cells
(b)	insulin	alpha cells	glucagon	beta cells
(c)	glycogen	beta cells	insulin	alpha cells
(d)	insulin	beta cells	glycogen	alpha cells

12. Which of the following describes correctly what is occurring at G and H?

(a) decreasing glycogenolysis is occurring at G and increasing glycogenesis is occurring at H
(b) decreasing gluconeogenesis is occurring at G and increasing gluconeogenesis is occurring at H
(c) increasing glycogenolysis is occurring at G and increasing glycogenesis is occurring at H
(d) increasing glycogenesis is occurring at G and decreasing gluconeogenesis is occurring at H

13. The process shown as J on the diagram helps to maintain homeostasis by

(a) increasing insulin levels in the bloodstream.
(b) reducing the amount of glycogen in the tissue cells.
(c) increasing lipogenesis in the tissue cells.
(d) reducing the amount of glucose in the bloodstream.

See next page

Questions 14 and 15 refer to the information below.

In a Year 12 Human Biology class, students were conducting an investigation into factors affecting stone tool production. They used different rock types to manufacture stone tools in the same ways as ancient hominins. The aim of the investigation was to create the most efficient cutting tools.

The following data was recorded by a group of students.

Rock type	Cutting ability of tool scale 1 (dull) – 10 (sharp)
A	9
B	4
C	6
D	4
E	7

14. On the basis of the information provided, which of the following describes correctly the experimental design features?

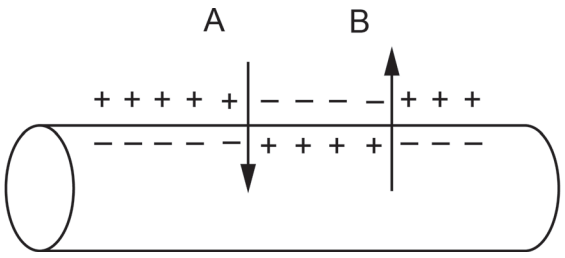
	Independent variable	Appropriate controlled variable	Type of data collected
(a)	method of tool preparation	cutting ability of tool	qualitative
(b)	cutting ability of tool	type of rocks used	quantitative
(c)	type of rocks used	cutting ability of tool	qualitative
(d)	type of rocks used	method of tool preparation	quantitative

15. Students were taught to use a method of stone tool manufacture which most closely matched that used in the Oldowan stone tool culture. The **best** description of this method is a

(a) simple percussion, whereby stones were struck against another to produce flakes.
(b) systematic removal of elongated flakes from a prepared core.
(c) pressure technique in which a pointed tool is used to remove small flakes along the edges of a core.
(d) prepared core is reworked, using flaking techniques to create a bifacial tool.

See next page

Questions 16 and 17 refer to the diagram and graph shown below.



Changes to ion concentration along a neuron

Stages in an action potential

16. Which of the stages indicated in the action potential graph corresponds to the change that is occurring along the neuron between A and B?

(a) 1
(b) 2
(c) 3
(d) 4

17. Which of the following names Stages 2 to 4 correctly, as shown in the graph?

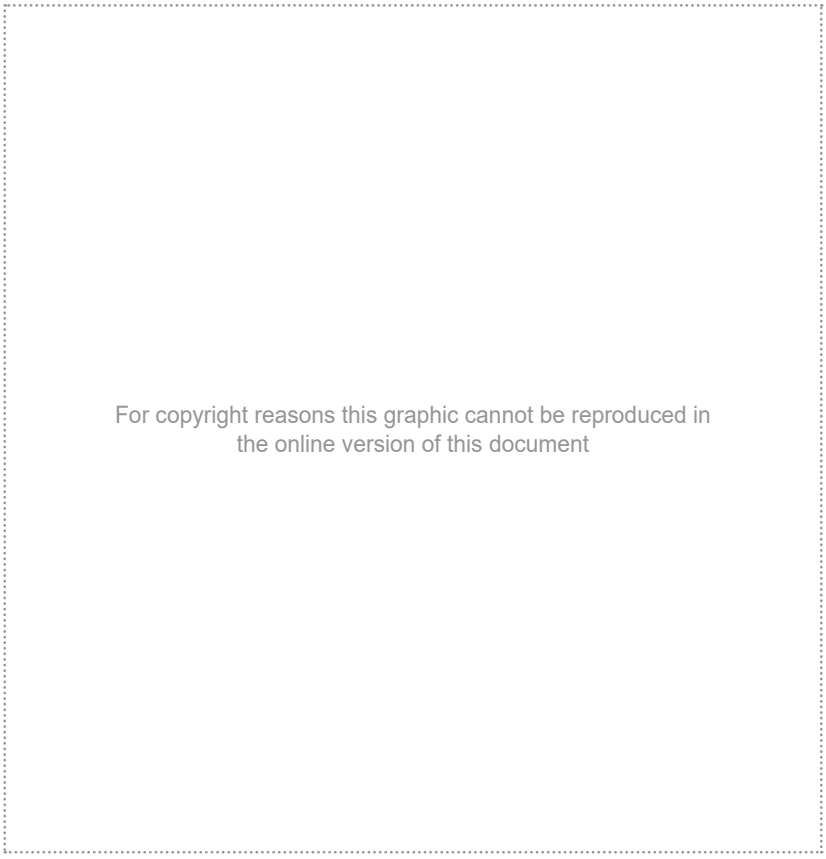
	2	3	4
(a)	repolarisation	depolarisation	hyperpolarisation
(b)	repolarisation	hyperpolarisation	depolarisation
(c)	depolarisation	hyperpolarisation	repolarisation
(d)	depolarisation	repolarisation	hyperpolarisation

18. The antibodies in breast milk provide a child with

(a) natural active immunity.
(b) artificial passive immunity.
(c) natural passive immunity.
(d) artificial active immunity.

See next page

Questions 19, 20 and 21 refer to the diagram shown below which represents the endocrine system.



19. Which of the following labels the endocrine glands shown in the diagram above correctly?

(a)	B = pituitary gland	E = thyroid gland	F = pancreas	I = testes
(b)	A = pituitary gland	C = pineal gland	D = thyroid gland	H = ovaries
(c)	B = pineal gland	E = thymus gland	F = adrenal glands	I = testes
(d)	A = hypothalamus	C = pituitary gland	D = thymus gland	H = ovaries

20. Which of the following hormones is **not** produced by structure F?

(a) calcitonin
(b) aldosterone
(c) adrenaline
(d) cortisol

21. Hormones produced from structure G are water-soluble in nature. This means that they affect cells by

(a) creating a hormone-receptor complex to activate genes controlling protein production.
(b) causing a secondary messenger substance to diffuse through the cell and activate enzymes.
(c) binding to receptor proteins to stimulate transcription.
(d) diffusing across the cell membrane and binding with a receptor protein.

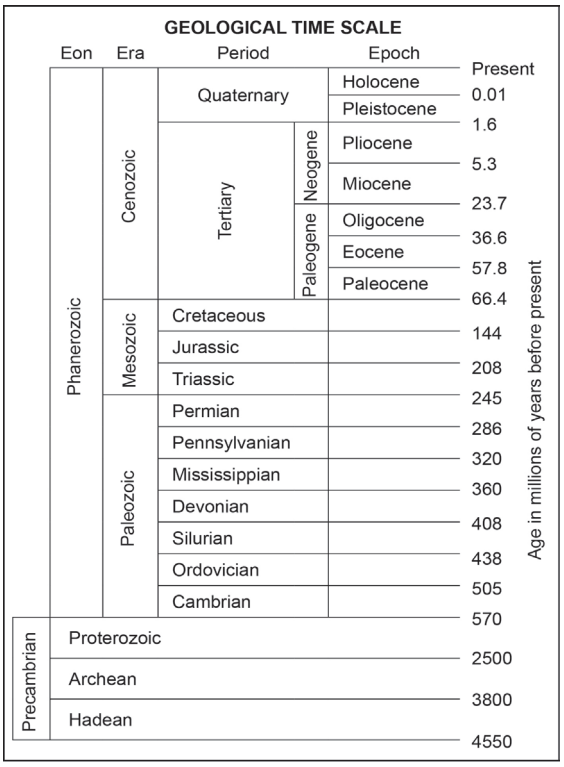
See next page

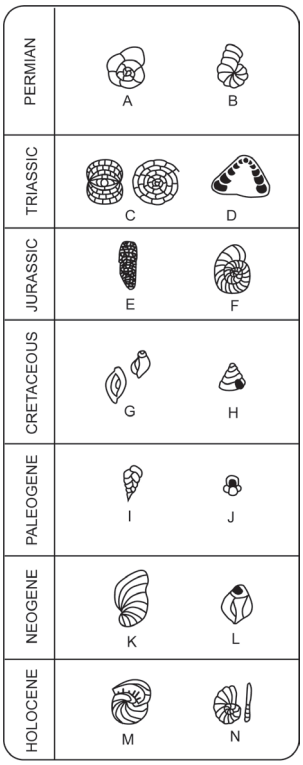
22. Australian children are routinely given the measles vaccine at 12 months and 18 months of age. The vaccine is known as a 'live attenuated' type.

The term 'attenuated' refers to a

(a) microorganism with a reduced ability to produce disease symptoms.
(b) vaccine that will not create an immune response.
(c) microorganism that has increased virulence so will produce disease symptoms.
(d) vaccine that has toxins found in it that are inactivated.

Questions 23 and 24 refer to the diagram shown below of index fossils and the geological time to which the fossils have been dated.





23. According to the information above, which of the following are index fossils that come from the same era?

(a) C and A
(b) D and L
(c) J and E
(d) I and M

24. Index fossils from which time group would be **most** useful in helping to date hominin specimens?

(a) Quaternary
(b) Mesozoic
(c) Cretaceous
(d) Paleocene

See next page

25. An athlete has just completed a 400 m race. What would occur in their sweat glands and skin arterioles at the completion of this race?

	Sweat glands	Skin arterioles
(a)	inactive	vasoconstriction
(b)	active	vasodilation
(c)	active	vasoconstriction
(d)	inactive	vasodilation

26. The following is a list of statements associated with fossil formation.

I. Decomposition is slowed by an anaerobic environment
II. Specimens need to be exposed to decomposers
III. Hard body parts become fossils through mineralisation
IV. Specimens need to be buried rapidly
V. Specimens need to be disturbed for fossilisation to occur

Which of the following describes correctly the conditions needed for fossilisation to occur?

(a) I, III and IV only
(b) I, II and IV only
(c) II, III, IV and V only
(d) II, IV and V only

Questions 27 and 28 refer to the information below.

A study was undertaken by which a small sequence of DNA was inserted into a virus. The virus was injected into veins of rats with Type 1 diabetes. The inserted DNA created cells that produced insulin. The purpose of this study was to find a way for humans suffering from Type 1 diabetes to eliminate the need for daily insulin injections.

27. The type of therapy used in this study is

(a) recombinant DNA technology.
(b) gene therapy.
(c) hormone replacement therapy.
(d) cell replacement therapy.

28. Ethical approval would be required for this trial to be undertaken in humans after analysis of the results in the rat study. Which of the following would be an important ethical consideration?

(a) number of people available to take part in the trial
(b) possible side effects of the therapy on humans
(c) cost of the trials
(d) approval by drug companies

See next page

29. Hepatitis B is a disease that can be prevented via vaccination. The vaccine is developed using recombinant DNA technology. Which of the following statements **best** describes how the vaccine is produced?

(a) gene of interest is isolated and placed into a plasmid, which is then placed into a bacterial cell, which then produces large quantities of the required vaccine
(b) plasmid is isolated, and a sticky end is produced, which is inserted into a gene; the plasmid is then replicated to produce large quantities of the vaccine
(c) two strands of DNA are isolated from two different species and recombined in a laboratory to create hybrid DNA strands
(d) two genes are cut out of DNA, using restriction enzymes; these genes are then recombined within a plasmid, which is then inserted into a bacterial cell, which can replicate and make large quantities of vaccine

Question 30 refers to the image shown below.

30. The diagram above is a representation of genetic drift. The **best** explanation for why it shows the process of genetic drift is that it represents

(a) differing selection pressures on various genotypes.
(b) alterations of allele frequencies in a population by natural selection.
(c) a random event resulting in a change to allele frequencies.
(d) genotypes of an isolated population changing over time.

End of Section One

See next page

Section Two: Short answer **50% (106 Marks)**

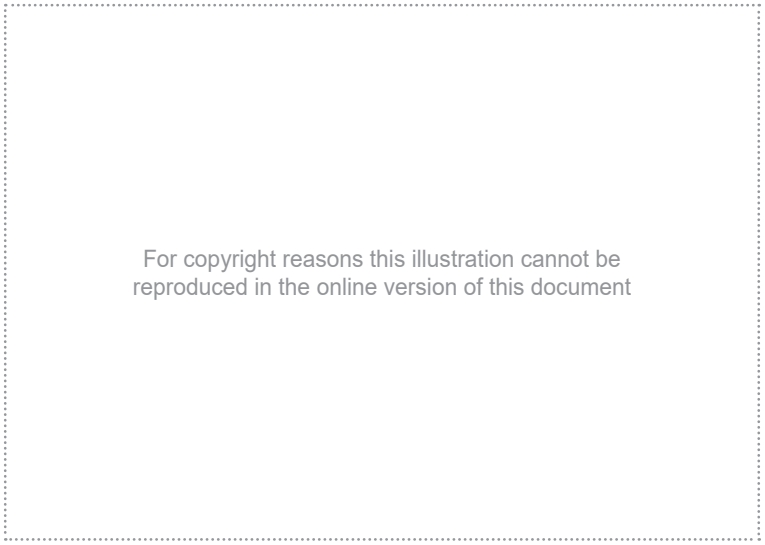
This section has **six** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

Question 31 **(18 marks)**

The following question refers to the diagram of a spinal reflex arc shown below.



(a) Identify the structures labelled A, B and C and justify your choice. (6 marks)

	Structure name	Justification
A		
B		
C		

White and grey matter can be found in the spinal cord, but it has not been shown on the diagram on page 14.

(b) (i) On the diagram on page 14, sketch and shade the location of the grey matter. (1 mark)

(ii) Outline **one** similarity and **one** difference between the grey matter found in the brain and the spinal cord. (2 marks)

Similarity: _____

_____

Difference: _____

_____

(c) Describe an advantage provided by a reflex arc in detecting and responding to a change in the environment. (2 marks)

_____

_____

_____

_____

(d) Explain how the role of the reflex arc would be impacted by damage occurring to Structure C. (3 marks)

_____

_____

_____

_____

_____

_____

Question 31 (continued)

A local anaesthetic, such as an epidural, can be used during surgery or in childbirth. This involves injecting anaesthetic into the spinal cord. The anaesthetic acts by either stopping the release of neurotransmitters or blocking receptors on sensory neurons.

(e) Contrast how each of the two actions of the anaesthetic described above would stop a person from feeling pain during surgery. (4 marks)

Stopping the release of neurotransmitters

Blocking receptors

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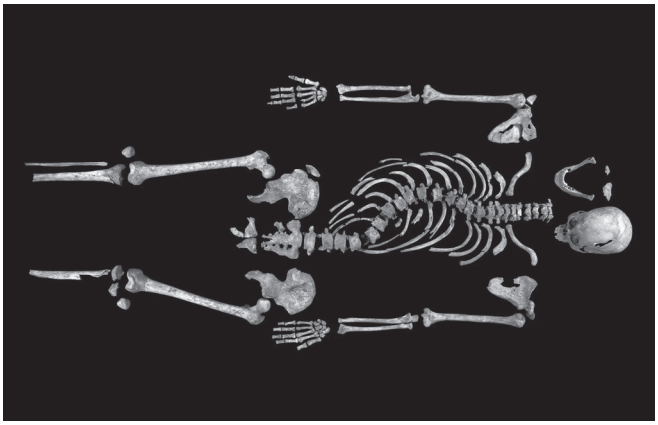
See next page

Question 32 **(14 marks)**

Richard III was King of England from 1483 to 1485, and the last English king to die in battle. He was buried in an unmarked grave. In 2012, 527 years after his death, a team of archaeologists unearthed his unmarked remains under a modern-day carpark.

Shown below is an image of the excavated remains of King Richard III.



To help confirm the remains were that of King Richard III, carbon-14 dating was conducted.

(a) (i) State the type of dating that carbon-14 dating is classed as. (1 mark)

(ii) Identify **two** features of the remains of King Richard III that would make them suitable for carbon-14 dating. (2 marks)

One:

Two:

When scientists dated the remains of King Richard III, they needed to correct for variations in the proportion of carbon isotopes in the atmosphere over time.

(iii) Explain why variations in atmospheric carbon can impact carbon-14 dating. (3 marks)

See next page

DNA samples were collected from King Richard III's remains and those of his ancestors. The results confirmed the remains were those of the king.

(b) Explain how DNA is used to establish genetic relationships. (3 marks)

An interesting anatomical characteristic visible in King Richard III's remains was an unusually shaped and positioned spine. He had often been referred to as a 'hunchback'. The discovery of the remains allowed scientists to look further into this claim and establish what may have been wrong with his spine.

(c) (i) Identify **two** characteristics of a typical human spine that allow for an upright stance and bipedal locomotion. (2 marks)

One:

Two:

(ii) Given that King Richard III's spine did not possess all the typical human features, deduce the negative impact this could have had on his ability to move using bipedal locomotion. (3 marks)

Question 33 **(19 marks)**

Sickle-cell anaemia is a disease caused by a genetic mutation. The mutation occurs in the gene which codes for the beta haemoglobin molecule, producing abnormal red blood cells. The type of mutation that occurs in the gene is known as a point mutation.

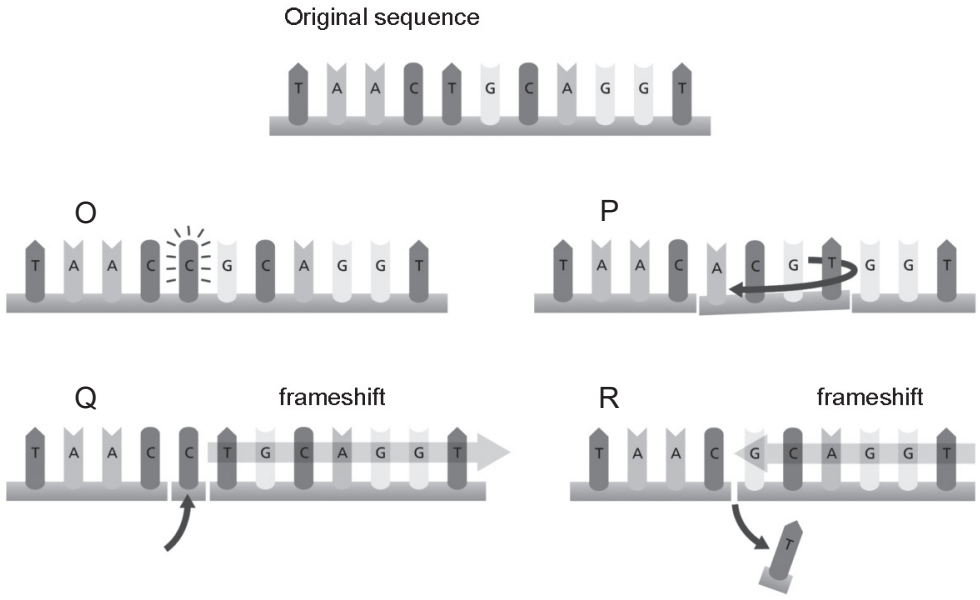
The table below shows the difference in the DNA sequence of normal haemoglobin and sickle-cell haemoglobin.

Sequence for normal haemoglobin												
ATG	GTG	CAC	CTG	ACT	CCT	GAG	GAG	AAG	TCT	GCC	GTT	ACT
Sequence for sickle-cell haemoglobin												
ATG	GTG	CAC	CTG	ACT	CCT	GTG	GAG	AAG	TCT	GCC	GTT	ACT

Mutation associated with sickle-cell anaemia

(a) Define the term 'point mutation'. (1 mark)

Different types of mutations are shown in the images below.



(b) (i) Select which **one** of the above mutations, labelled O, P, Q and R, is the same as the sickle-cell mutation. Justify your answer. (2 marks)

See next page

(ii) Select which **one** of the mutations on page 20 labelled O, P, Q and R, could be classified as an inversion mutation. Justify your answer. (2 marks)

All the mutations shown on page 20 can occur during DNA replication.

(iii) Explain how a mutation may occur during DNA replication. (3 marks)

(iv) List **two** other processes that can lead to mutations occurring. (2 marks)

One: _____

Two: _____

Question 33 (continued)

Sickle-cell anaemia and sickle-cell trait are different conditions that can be present in populations with the beta haemoglobin mutation.

(c) Complete the table below, contrasting the **two** conditions. (4 marks)

	Sickle-cell anaemia	**Sickle-cell trait**
Genetic makeup of individual		
Effect on haemoglobin of individual		

(d) Explain why the sickle-cell mutation persists in some populations. (5 marks)

See next page

Question 34 **(18 marks)**

An investigation was undertaken to determine the changes in the levels of anti-diuretic hormone (ADH) in the blood over a 24-hour period and the effect that changes in ADH levels might have on urine output.

The ADH levels in the bloodstream of 20 healthy adults was measured at 2 am and 2 pm over five days and the mean was calculated.

The volume of urine that was produced from 8 pm until 8 am and 8 am until 8 pm was also measured over five days and the mean was calculated.

The results are shown below.

Mean ADH levels (pg mL^{-1})	
2 am	4.7
2 pm	2.1
Mean urine volume (mL h^{-1})	
8 pm to 8 am	34.7
8 am to 8 pm	71.5

(a) State a hypothesis for the investigation. (1 mark)

(b) (i) Calculate the difference between the mean urine volumes for the different time periods. (1 mark)

(ii) Outline the purpose of having a large sample size and calculating a mean ADH level or mean urine volume for this investigation. (2 marks)

Question 34 (continued)

(c) Explain the relationship between the levels of ADH at 2 am and the amount of urine produced between the hours of 8 pm and 8 am. (4 marks)

Normal ranges for ADH levels are between 2 and 5.9 pg mL^{-1}. An individual was tested and found to have a lower than normal level of ADH in their blood.

(d) Explain why this could indicate damage to the hypothalamus. (5 marks)

See next page

Aldosterone is another hormone involved in the regulation of water balance.

(e) (i) Name the endocrine gland that secretes aldosterone. (1 mark)

(ii) Explain the mechanism by which aldosterone helps to regulate water balance. (4 marks)

See next page

Question 35 **(16 marks)**

Mary Mallon was an asymptomatic carrier of the *Salmonella typhi* bacteria who caused several outbreaks of typhoid fever in the early 1900s. She became known as 'Typhoid Mary' and the story is a famous example of disease transmission and the need for public health measures.

Mary worked as a cook in New York homes, with many people developing typhoid fever while she was employed. She was never sick with the disease herself but was tested and identified as an asymptomatic carrier of the disease. Individuals become infected with typhoid fever from the ingestion of the *Salmonella typhi* bacteria. It is believed Mary was responsible for as many as 122 cases of the disease.

(a) Given the evidence outlined above, identify the most likely mode of transmission for the typhoid fever pathogen. (1 mark)

(b) Identify the location of the most important external body defence mechanism in preventing the spread of *Salmonella typhi* and outline **two** ways in which it prevents pathogens entering the internal environment. (3 marks)

Location:

One:

Two:

(c) (i) List **two** ways in which a fever can help the body fight an invading pathogen. (2 marks)

One:

Two:

See next page

(ii) Explain the physiological mechanisms that produce a fever. (4 marks)

Bacteria can be treated with either antibiotics or a vaccine.

(d) (i) Describe the key difference between when a person should be treated with antibiotics and when they should be treated with a vaccine. (2 marks)

(ii) Present **two** separate arguments for whether antibiotics and/or a vaccine is the best method of treating a population exposed to, or at risk of, exposure to a disease such as typhoid fever. (4 marks)

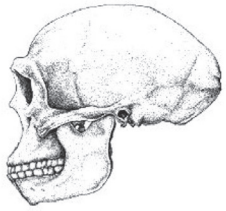
One:

Two:

See next page

Question 36 **(21 marks)**

The skulls below represent four types of hominins. They are in no particular order or sequence.



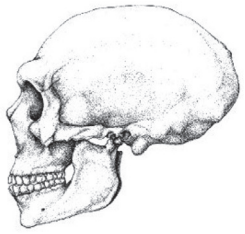
A

For copyright reasons this illustration cannot be reproduced in the online version of this document but may be viewed online at the following link https://web.archive.org/web/20240508165329/http://www.talkorigins.org/faqs/homs/sinanth.html. First image, third skull (Homo sapens)

B

For copyright reasons this illustration cannot be reproduced in the online version of this document but may be viewed online at the following link https://web.archive.org/web/20081106175202/www.ecotao.com/holism/hu_austral.htm

C



D

(a) Considering only the lower jaw, identify the letters of the skulls in evolutionary order. (1 mark)

(b) State **three** separate features apparent in the diagrams that led you to choose the order identified in part (a). (3 marks)

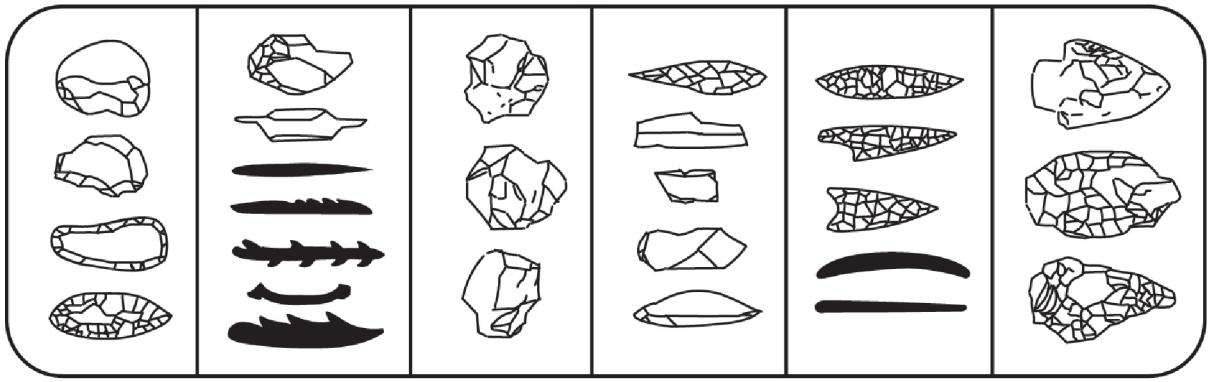
One:

Two:

Three:

See next page

The tool diagrams below represent the types of tools used by hominins. They are in no particular order or sequence.



(c) (i) State the numbers of the **three** sets of tools associated with early *Homo sapiens* or Cro-Magnon man. (1 mark)

(ii) Outline **two** features evident in the tools of Set 6 above that indicate they are examples of Acheulean tool culture. (2 marks)

One: _____

Two: _____

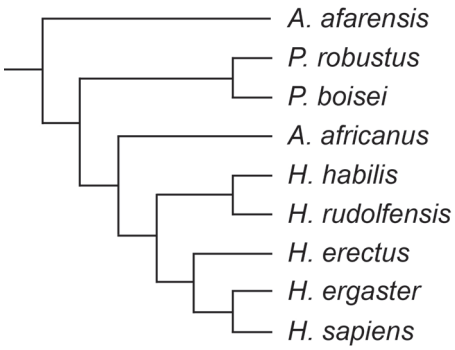
Scientists stated that comparison of Set 2 and Set 3 above provided evidence that hominins developed more specialised roles within their communities over time.

(iii) Explain how this conclusion could be made from these tools. (3 marks)

See next page

Question 36 (continued)

The diagram below of a phylogenetic tree illustrates a possible evolutionary relationship between various hominin species.



Answer the following questions based on information provided in the phylogenetic tree diagram.

(d) (i) Identify the organisms most closely related to *P. boisei.* (1 mark)

(ii) Describe **one** feature of the skull of *A. africanus* that can be used to justify the positioning of *A. africanus* in the phylogenetic tree in relation to the Homo specimens. (2 marks)

(iii) State where *H. neanderthalensis* would most likely be placed on the tree diagram. Justify your answer. (2 marks)

Over many generations, hominin species are believed to have evolved from an ape-like ancestor. What separates all hominins from the other great apes is the ability to walk bipedally.

(e) Using the concept of natural selection, explain how bipedalism evolved in early hominins. (6 marks)

End of Section Two

See next page

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

This section contains **four** questions. You must answer **two** questions.

Questions 37 and 38 are from Unit 3. Questions 39 and 40 are from Unit 4. Answer **one** question from Unit 3 and **one** question from Unit 4.

Responses could include clearly labelled diagrams with explanatory notes; lists of points with linking sentences; clearly labelled tables and graphs; and annotated flow diagrams with introductory notes.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 50 minutes.

Unit 3

Choose **either** Question 37 **or** Question 38.

Indicate the question you will answer by ticking the box next to the question. Write your answer on pages 34–38. When you have answered your first question, turn to page 39 and indicate on that page the second question you will answer.

☐ **Question 37** **(20 marks)**

(a) Explain how the nervous system and endocrine system work together to prevent body temperature from falling below optimum levels in the short-term. (10 marks)

Central sleep apnoea is a condition in which people stop breathing while they are asleep. The change in gas levels in the blood then activates a survival reflex that wakes the individual up (often many times a night) so that they resume breathing.

(b) Describe how normal breathing rate is maintained and describe how a change in blood gas concentrations in a person with sleep apnoea would cause them to wake. (10 marks)

or

See next page

Question 38 **(20 marks)**

(a) While the nervous and endocrine systems work together to co-ordinate the functions of the body systems, they differ in several ways. Contrast **three** ways in which these systems operate. (6 marks)

The autonomic nervous system helps to control homeostatic mechanisms. The effects of these can often be demonstrated consciously. For example, an athlete competing in an important race event noticed the following whilst standing waiting for the race to start; they had a 'funny feeling' in their stomach, they were sweating, the light seemed brighter than usual, and they felt their heart was going to explode.

(b) Outline the neural pathway of the autonomic nervous system activated in the athlete and explain the reasons for these symptoms. (14 marks)

Question number: _____

See next page

See next page

See next page

See next page

See next page

Unit 4

Choose **either** Question 39 **or** Question 40.

Indicate the question you will answer by ticking the box next to the question. Write your answer on the pages provided.

☐ **Question 39** **(20 marks)**

Researchers in Ethiopia found a relatively complete hominin skeleton. Looking at the skeleton it was not clear which form of locomotion the hominin had used. The specimen showed features that could be linked with both bipedalism and brachiation.

(a) Identify **six** anatomical features of the skeleton that could have been present in the shoulders, arms, and hands to support brachiation as a means of locomotion, and explain how the shoulders, arms and hands allow for brachiation. (10 marks)

(b) Identify **two** anatomical features of the skeleton that could have been present in the pelvis to support bipedalism as a means of locomotion, and outline how these features would allow for bipedalism. (4 marks)

Researchers were unable to provide an actual date for the fossil skeleton. They were however, able to use stratigraphy to date the fossil.

(c) Name and describe **two** ways in which stratigraphy is employed to date a fossil. (6 marks)

or

☐ **Question 40** **(20 marks)**

Polymerase chain reaction (PCR), gel electrophoresis and DNA sequencing are biotechnological processes that can be used to help provide evidence for evolution.

(a) Contrast PCR and gel electrophoresis in terms of the purpose, processes and end products formed. (10 marks)

(b) Define the term ‘DNA sequencing’ and identify **five** ways in which DNA sequencing can be used to provide evidence for evolution. (6 marks)

(c) Explain how the process of bioinformatics can be applied to help determine the relatedness of species. (4 marks)

End of questions

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

ACKNOWLEDGEMENTS

Questions 3–5 Adapted from: van Ginneken, V. (2020, March). [Review]: Where Darwin Neglected to Explain the Human-brain Encephalization: 1). Ecological Arguments Supporting the Savannah Dryland (SDL) Hypothesis (Fig. 3) [Graph]. *ES Journal of Neurology, 1*(1). Retrieved April, 2024, from https://www.researchgate.net/publication/340298404_ES_Journal_of_Neurology/download?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6Il9kaXJlY3QiLCJwYWdlIjoiX2RpcmVjdCJ9fQ
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Question 32 University of Leicester. (n.d.). [Photograph of the skeleton of King Richard III]. Retrieved April, 2024, from https://le.ac.uk/richard-iii/identification/osteology/analysing-the-skeleton

Question 33(b)

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Laura Olivares Boldú / Wellcome Connecting Science yourgenome.org

Question 36

Skulls A and D

Maizels, D. (1994). *Comparison of Hominid Skulls* [Illustration]. Artwork © Copyright 1994 D.J. Maizels, Zoobotanica Scientific Illustration.

Skull B

Campbell, B. (1988). [Illustration of a skull]. Retrieved May, 2024, from https://web.archive.org/web/20240508165329/http://www.talkorigins.org/faqs/homs/sinanth.html

Skull C

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