



ATAR course examination, 2018

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.

Student number: In figures

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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: non-programmable calculators approved for use in this 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	9	9	90	109	50
Section Three Extended answer	3	2	50	40	20
Total					100

Instructions to candidates

- The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2018*. Sitting this examination implies that you agree to abide by these rules.
- Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
- 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. Wherever possible, confine your answers to the line spaces provided.

Section Three: Consists of three questions. You must answer two questions. Tick the box next to the question you are answering. Write your answers in this Question/Answer booklet.

- 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.
- 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.

1. The part of the brain associated with thought and reasoning is the
 - (a) cerebellum.
 - (b) medulla oblongata.
 - (c) cerebrum.
 - (d) hypothalamus.

2. Which of the following are all bipedal features seen in a hominid foot specimen?
 - (a) non-opposable big toe, two arches and large heel bone
 - (b) opposable big toe, one arch and small heel bone
 - (c) non-opposable toe, one arch and large heel bone
 - (d) opposable big toe, two arches and small heel bone

3. Thalassaemia and sickle-cell anaemia are both genetic diseases that
 - (a) result in sickle-shaped haemoglobin.
 - (b) are caused by a genetic mutation associated with haemoglobin formation.
 - (c) occur at high incidences in some populations.
 - (d) are shown to have a heterozygote advantage in some circumstances.

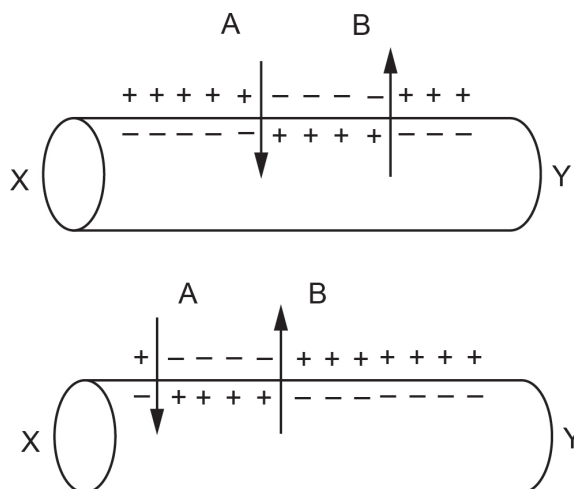
4. Which of the following descriptions below is correct?

	Type of immunity	Example
(a)	Natural passive immunity	Antibodies injected into the blood
(b)	Artificial active immunity	Manufacturing antibodies after contracting a disease
(c)	Active passive immunity	Antibodies crossing the placenta of a foetus
(d)	Natural active immunity	Manufacturing antibodies after contracting a disease

5. Pyrogens are substances that trigger the hypothalamus to bring about
 - (a) inflammation.
 - (b) an immune response.
 - (c) a fever.
 - (d) swelling.

See next page

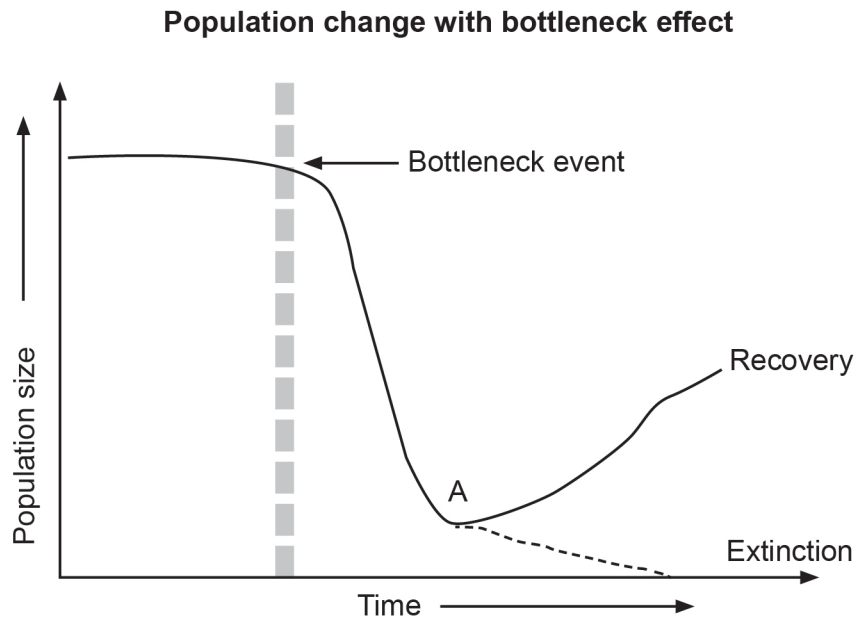
Questions 6–8 refer to the diagram below that represents a nerve impulse moving along an axon of a neuron.



6. If the action labelled 'A' in the diagram represents ions entering the neuron, which of the following statements about 'A' would be true?
- depolarisation and nerve impulse moving from X to Y
 - repolarisation and nerve impulse moving from X to Y
 - depolarisation and nerve impulse moving from Y to X
 - hyperpolarisation and nerve impulse moving from Y to X
7. Which of the following is the threshold current required for an action potential to be generated?
- 55 mV
 - 55 mV
 - 70 mV
 - 70 mV
8. After an action potential has been generated, certain ions flow out of the neuron at 'B'. These are
- sodium ions.
 - potassium ions.
 - calcium ions.
 - magnesium ions.
9. For which of the following sets of data is a line graph not suitable?
- the body mass of all female students at a high school
 - the average body fat content of a particular teenage boy at different ages
 - the average pulse rate of a student before, during and after exercise
 - the average amount of food eaten by teenage boys at different environmental temperatures

See next page

Question 10 refers to the diagram below:

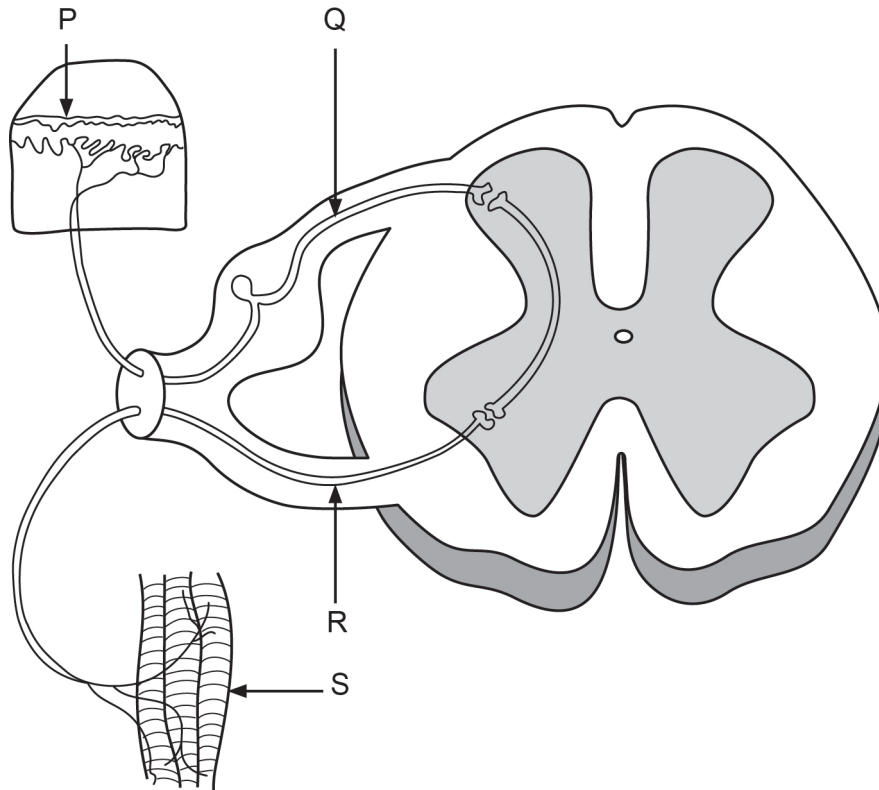


10. The bottleneck effect shown in the diagram is a catastrophic event that occurs to a population, resulting in a sharp reduction to a gene pool. At point A on the graph, the population has a chance of either recovery or extinction. What is the most likely characteristic of the population, after the bottleneck event, that creates this situation?
- The population must still be recovering from the catastrophic event and not have strong alleles present in the gene pool.
 - A small population size means the gene pool contains highly-varied alleles producing offspring not well suited to the environment.
 - Members of the population now vary too much and cannot produce fertile offspring.
 - A small population size means it is more susceptible to random genetic drift.
11. A body structure now reduced in function, but which may have been used in an ancestor, is an example of
- a pentadactyl limb.
 - a vestigial organ.
 - a fossil.
 - an analogous structure.
12. The descending tracts contained in the white matter of the spinal cord
- carry nervous impulses down the spinal cord to lower motor neurons.
 - contain motor axons to carry nervous impulses away from the peripheral nervous system.
 - contain sensory axons to carry nervous impulses to the brain.
 - carry nervous impulses up the spinal cord to the brain.

See next page

13. Treatment for Parkinson’s disease with cell replacement therapy techniques could involve
- (a) injecting patients with dopamine that has been manufactured in the laboratory.
 - (b) altering the DNA structure of sufferers’ nerve cells to remove the affected gene causing the disease.
 - (c) using stem cells to grow dopamine-producing nerve cells in the laboratory.
 - (d) removing damaged nerve tissue from the brain by a surgical procedure.

Questions 14 and 15 refer to the diagram below:



14. The structure labelled ‘R’ can be described as an
- (a) afferent neuron carrying information away from the spinal cord.
 - (b) afferent neuron carrying information toward the spinal cord.
 - (c) efferent neuron carrying information away from the spinal cord.
 - (d) efferent neuron carrying information toward the spinal cord.
15. Which of the following statements about the detection of a stimulus in the above reflex arc is correct?
- (a) detected by receptors labelled ‘P’ and transmitted through sensory neurons labelled ‘Q’
 - (b) detected by receptors labelled ‘S’ and transmitted through sensory neurons labelled ‘R’
 - (c) detected by receptors labelled ‘S’ and transmitted by interneurons labelled ‘R’
 - (d) detected by sensory neurons labelled ‘P’ and transmitted through motor neurons labelled ‘Q’

See next page

16. Around 14 000 years ago, about 70 humans crossed a land bridge from Siberia to North America. DNA studies have shown that these 70 humans are the ancestors of all the Native American tribes found in North America. On the basis of this information, characteristics shared by all Native Americans can be best described as being a result of
- random genetic drift.
 - natural selection.
 - speciation.
 - founder effect.

Questions 17 and 18 refer to the diagram below:

For copyright reasons this diagram cannot be reproduced in the online version of this document, but may be viewed at <https://www.neuroscientificallychallenged.com/blog/know-your-brain-meninges>

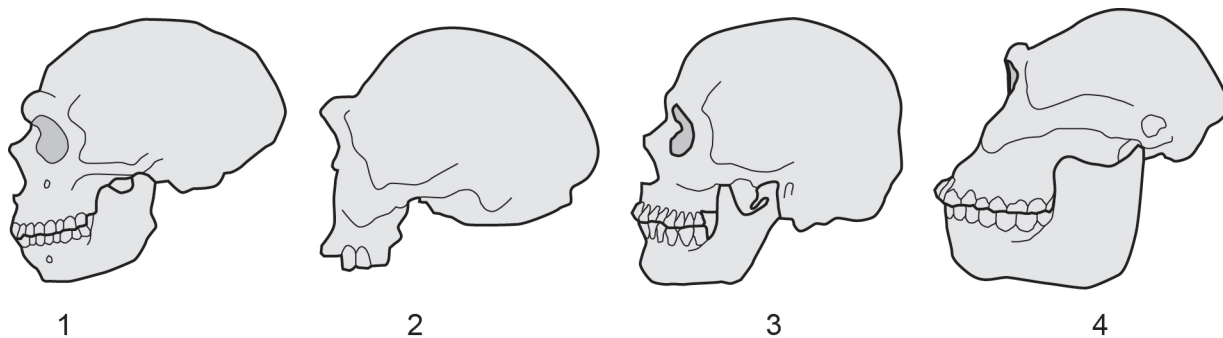
17. X, Y and Z collectively make up the meninges of the brain. Which of the following correctly identifies X, Y and Z?

	X	Y	Z
(a)	Pia mater	Arachnoid membrane	Dura mater
(b)	Arachnoid membrane	Dura mater	Pia mater
(c)	Dura mater	Pia mater	Arachnoid membrane
(d)	Dura mater	Arachnoid membrane	Pia mater

18. Cerebrospinal fluid circulates in the space around the structure labelled 'Y'. The main role of cerebrospinal fluid is to
- separate the brain from the skull.
 - supply blood to and remove waste products from the brain.
 - act as a shock absorber on impacts to the brain.
 - regulate the temperature of the brain tissue.

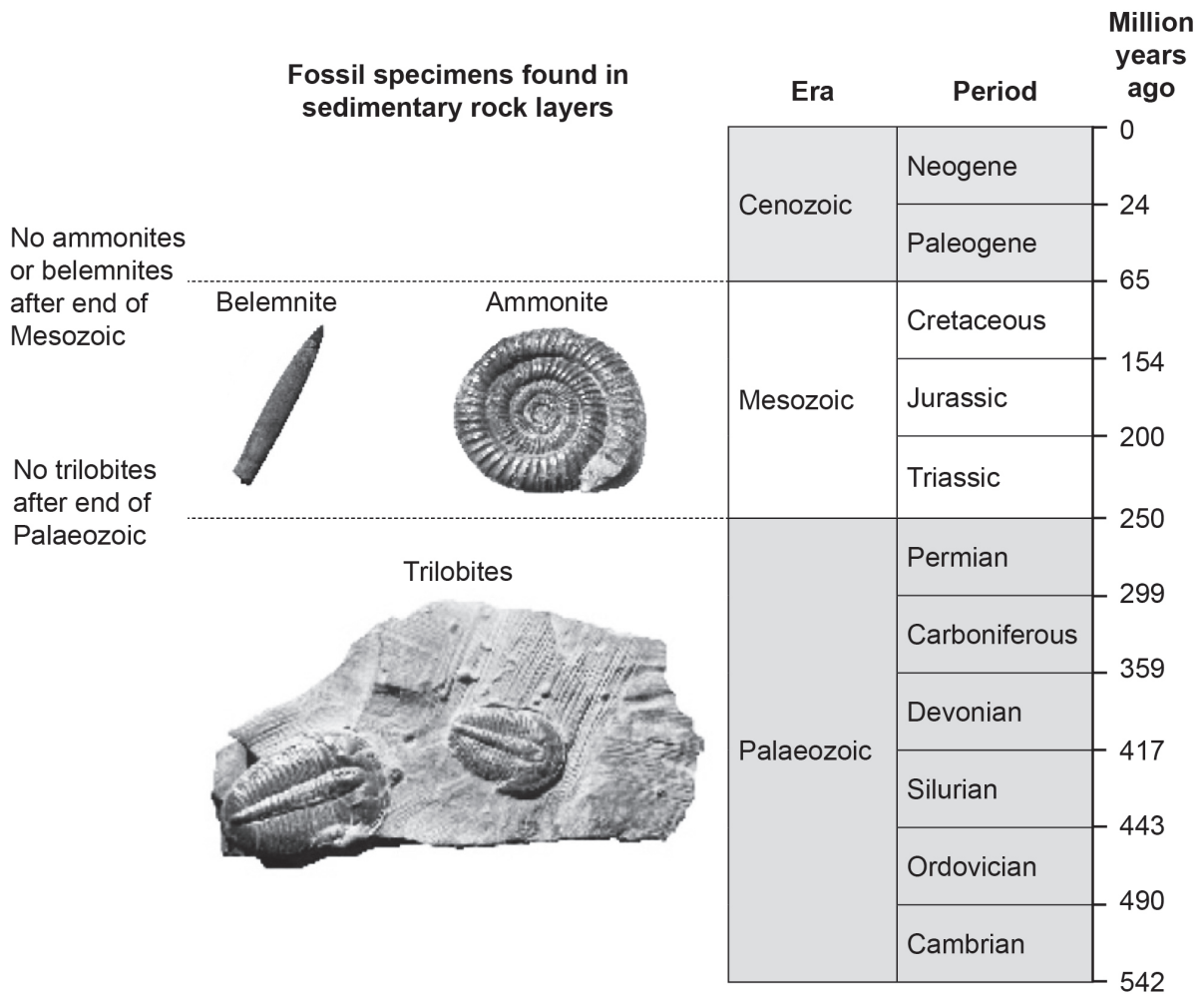
19. Which of the following is a possible reason why Australians choose **not** to complete immunisation programs for their children?
- (a) cannot afford the cost of the vaccine
 - (b) a religious objection to medical technologies
 - (c) believe vaccines increase their children's immunity to diseases
 - (d) forget to visit the doctor at the time a vaccination is required
20. As part of the first line of defence in the human immune system, naturally-occurring barriers to invading pathogens include
- (a) lysozymes in tears.
 - (b) the production of antibodies.
 - (c) the engulfing of pathogens by phagocytes.
 - (d) inflammation at the site of infection.

Question 21 refers to the images below:



21. The images above are of four fossil hominid skulls. Which sequence **best** shows the order from the most ancient to the most modern fossil skull?
- (a) 2, 4, 1, 3
 - (b) 4, 2, 1, 3
 - (c) 3, 1, 2, 4
 - (d) 4, 2, 3, 1
22. A person suffering from fatigue and weight gain who has been prescribed synthetic thyroid hormones by a doctor **most** likely has the disease known as
- (a) hyperthyroidism.
 - (b) hypothyroidism.
 - (c) Grave's disease.
 - (d) goitre.

Questions 23 and 24 refer to the information and diagram below:



23. If a trilobite was found in another sedimentary rock location, it could be concluded that the fossil in the new location
- existed in the Mesozoic era.
 - was older than 542 million years.
 - existed in the Palaeozoic era.
 - was younger than 250 million years.
24. Using the information in the diagram above, dating new fossil finds would involve
- correlating rock strata containing index fossils.
 - absolute dating techniques.
 - radiometric dating containing known fossils.
 - the principle of superposition.

See next page

25. The following statements describe how vaccines, antibiotics and/or antiviral medications work.
- I. treat viruses and bacterial infections
 - II. treat only viral infections
 - III. can provide broad-spectrum treatment to a variety of pathogens
 - IV. are specific to each pathogen
 - V. are only effective at the time when taken
 - VI. can provide lasting immunity

Which of the following statements are true for antiviral medications?

- (a) I, III, V
 - (b) II, III, VI
 - (c) II, IV, V
 - (d) I, IV, VI
26. Which of the following states correctly a difference between the endocrine system and the nervous system?

	Endocrine system	Nervous system
(a)	Affects one target organ at a time	Affects many target organs at one time
(b)	All or none response	Can produce strong or weak responses
(c)	Electrochemical message	Chemical message
(d)	Long-lasting response	Short-lived response

27. Gemma is scratched on the leg by her cat. The next day, she notices an inflammatory response occurring around the area where she has been scratched. In the inflamed area
- (a) the skin will become swollen and cold to touch.
 - (b) red blood cells will release histamine.
 - (c) mast cells will produce pus.
 - (d) there will be increased blood flow.
28. The thirst reflex is caused by
- (a) an increased osmotic pressure of the blood, triggering nervous impulses to the cerebrum.
 - (b) a decreased osmotic pressure of the blood, triggering hormonal messages to the cerebrum.
 - (c) a decreased volume of extracellular fluid, triggering hormonal messages to the cerebrum.
 - (d) an increased volume of extracellular fluid, triggering nervous impulses to the cerebrum.

Questions 29 and 30 refer to the information and table below:

Lydia, Jake and Ahmed conducted an experiment to investigate the effects of drinks containing caffeine on urine output.

Jake drank nothing for two hours and then drank one litre of water as quickly as he could. His urine was collected every 20 minutes for the following two hours. He again drank nothing for two hours before repeating the test with Coke Zero[®] and then with Red Bull Sugarfree[®]. The results are recorded in the table below.

Time (minutes)	Urine output (mL)		
	Water	Coke Zero [®]	Red Bull Sugarfree [®]
20	60	63	61
40	81	90	97
60	75	85	95
80	52	65	71
100	41	43	50
120	43	45	42

29. From the data in the table, which of the following statements could be correct?

- (a) drinking water causes urine output to decrease
- (b) drinking Coke Zero[®] has no effect on urine output
- (c) drinking Red Bull Sugarfree[®] causes urine output to increase
- (d) drinking water causes a greater increase in urine output than Coke Zero[®]

30. From the data in the table, which of the following statements could be correct?

- (a) The experiment is not valid because it does not have a control but is reliable due to the repeated trials.
- (b) The experiment is not valid because it does have a control and is not reliable due to having repeated trials.
- (c) The experiment is valid due to variables being kept the same and reliable because of repeated trials.
- (d) The experiment is valid due to variables being kept the same but not reliable due to there being no repeated trials.

End of Section One

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Section Two: Short answer

50% (109 Marks)

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

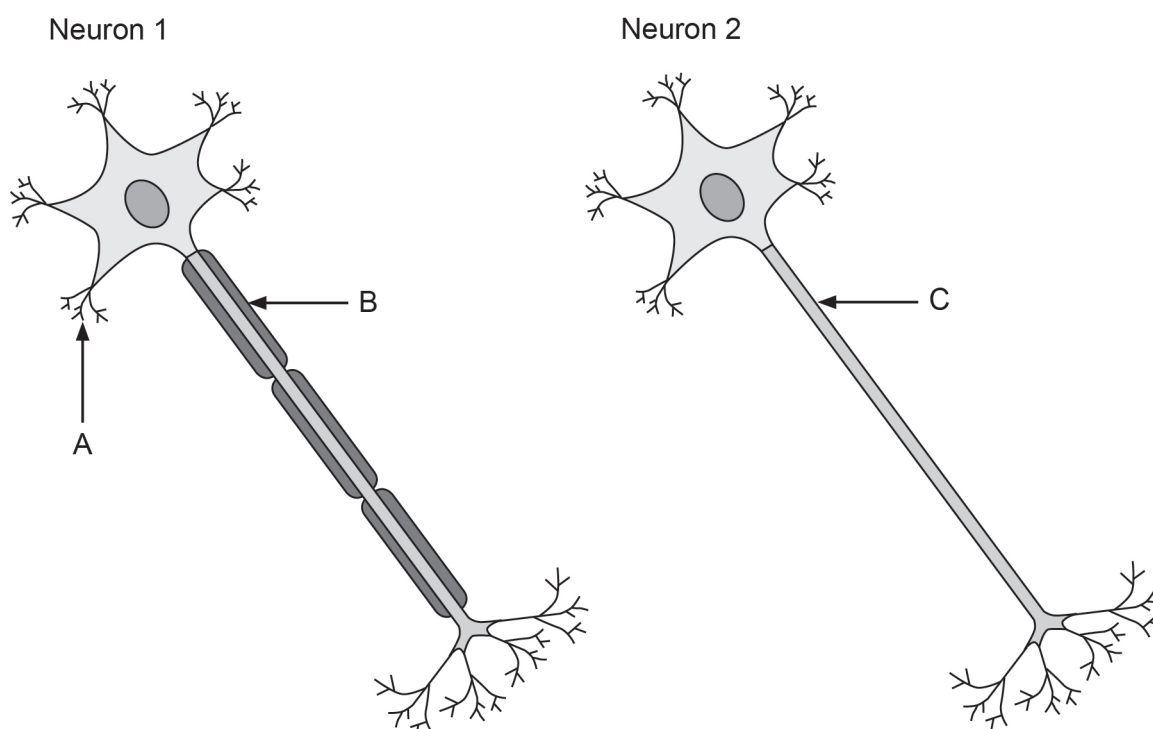
Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the end of the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

Question 31

(12 marks)

The diagram below shows two motor neurons.



(a) Using the information above, complete the following table. (3 marks)

Label	Structure name
A	
B	
C	

See next page

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- (b) Describe why nerve transmission would be much faster in Neuron 1 than in Neuron 2. (2 marks)

Neuron 1 can be found within the somatic division of the nervous system.

- (c) (i) To what structures in the body would these neurons take messages? (1 mark)

- (ii) How does the pathway of a nerve impulse travelling through the neurons of the somatic division differ to that travelling within the autonomic division? (2 marks)

Natasha walked into her Human Biology class a few moments late, only to find everyone putting their books and notes away. Her teacher was preparing to hand out a test. Natasha did not know the test was being done and started panicking. The teacher placed the test down on the desks and told the students to begin. Natasha suddenly felt like she was going to vomit.

- (d) (i) Identify the division of the nervous system activated in Natasha's body during this situation. (1 mark)

- (ii) What was happening in Natasha's body to cause her to feel the way she did? (2 marks)

- (iii) Identify another physiological response that could have been occurring in her body during this situation. (1 mark)

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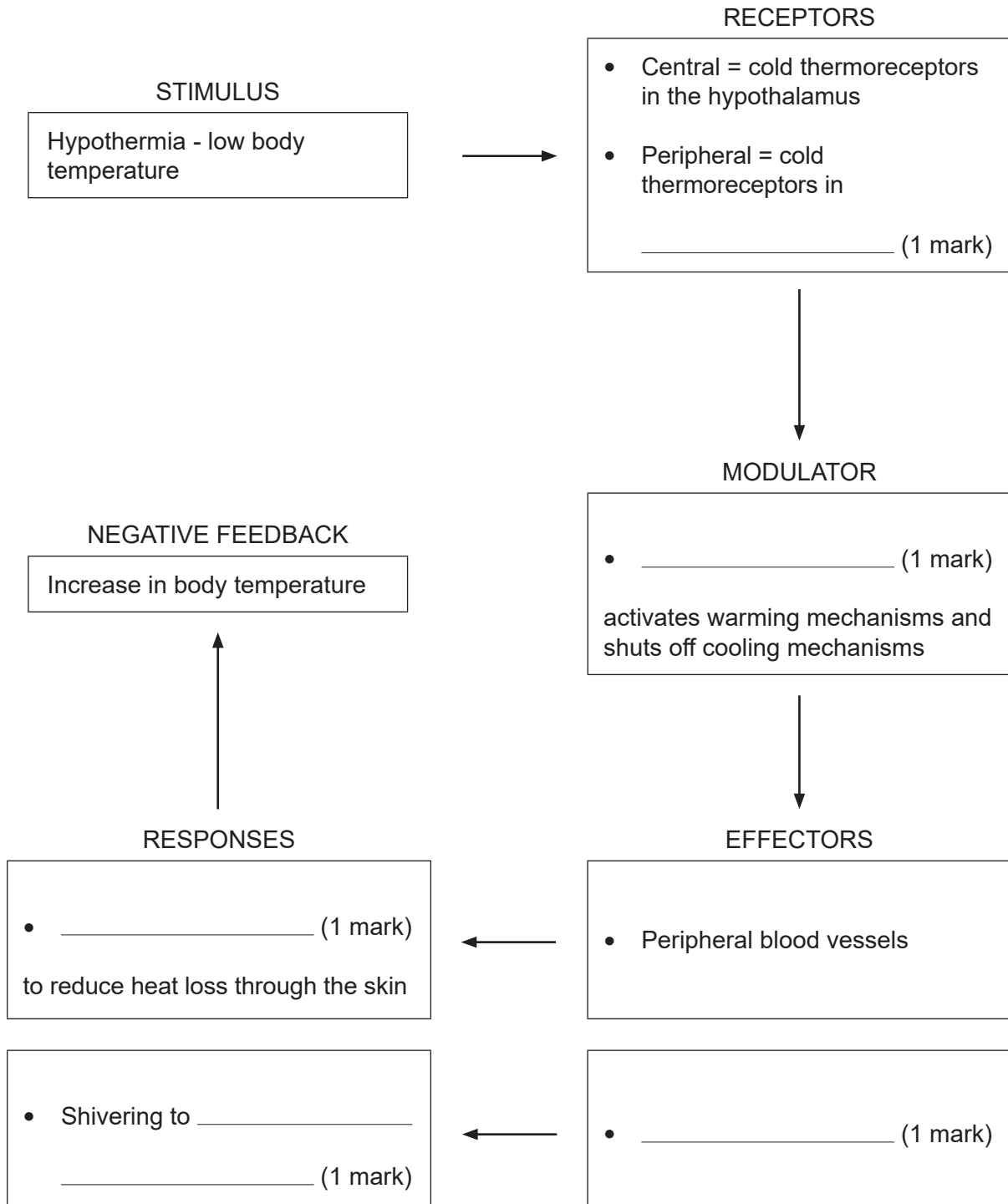
Question 32

(11 marks)

Jai was snowboarding in Japan when he was caught in an avalanche. He was partially buried in the snow and it took several hours to find him. Luckily he was relatively unhurt but, when found, was suffering from the early stages of hypothermia.

Below is a negative feedback model showing the physiological responses to hypothermia.

- (a) Complete the feedback loop below by writing the appropriate word/s in the spaces provided. (5 marks)



See next page

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- (b) The people who found Jai in the snow gave him first aid. Identify **two** behavioural strategies the first aiders could have employed to help his body recover from hypothermia. (2 marks)

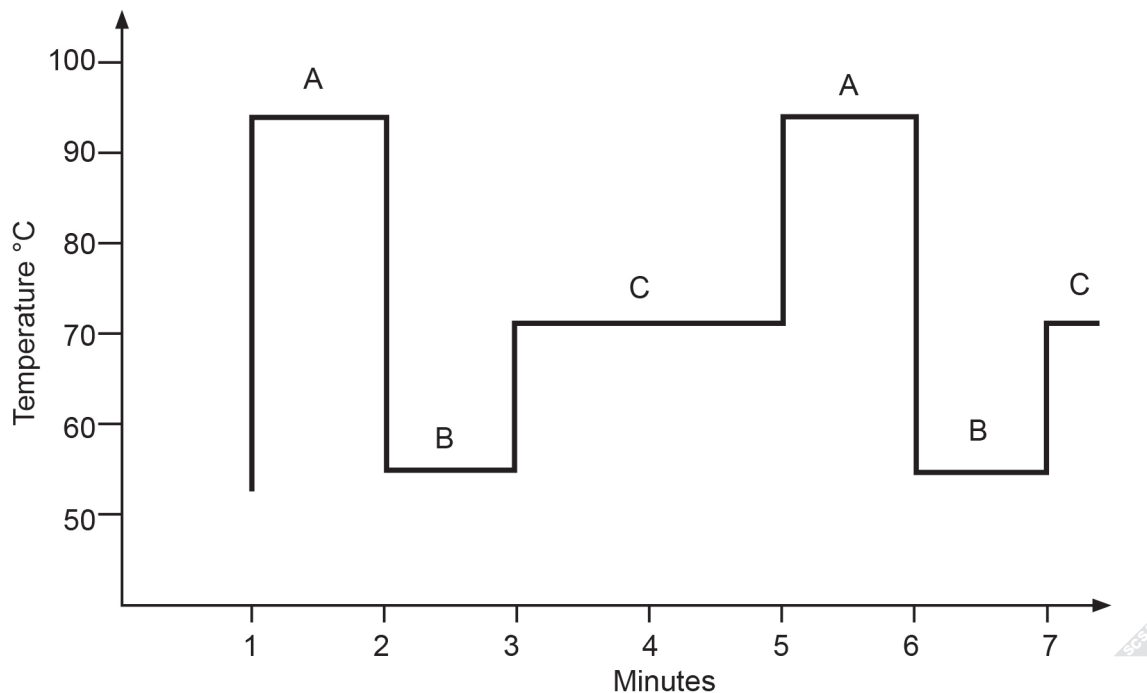
- (c) Several days after Jai was caught in the avalanche, he developed a cold, with a runny nose and sore throat. His friends said he must have become sick from being in the cold environment. Using your knowledge of infection and immune response, explain how this could not be the case and how, in fact, Jai would have become unwell. (4 marks)

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Question 33

(13 marks)

Polymerase chain reaction (PCR) is a biotechnological technique used to amplify very small amounts of DNA. The diagram below is a graphical representation of the PCR process.



- (a) The graph above is missing some important information. Identify **two** pieces of information that should have been included when drawing the graph. (2 marks)

- (b) The stages in PCR are labelled 'A', 'B' and 'C' on the graph.

- (i) What name is given to stage 'C'? (1 mark)

- (ii) Describe what occurs at stage 'B'. (2 marks)

- (c) Describe **two** situations in which PCR could be used and the information that would be gathered. (4 marks)

Polymerase chain reaction and gel electrophoresis are often used to study genetic diversity.

- (d) Explain how the technique of gel electrophoresis separates DNA fragments of different sizes. (4 marks)

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Question 34

(13 marks)

Lovejoy and Raghanti (2018) studied the neurotransmitter levels in brain samples from humans, chimpanzees, gorillas, baboons and monkeys. Results from the study show that varying amounts of several neurotransmitters found in the brain may be the key to what makes humans differ from other primates. While all the species had many of the same types of neurotransmitters, scientists found that, compared to other primates, humans have much higher levels of dopamine and lower levels of acetylcholine.

- (a) The study could be used to provide supporting data in the field of comparative biochemistry. Justify this statement. (2 marks)

- (b) State the role of neurotransmitters in the brain and nervous system. (1 mark)

Lovejoy and Raghanti suggest that the different neurotransmitter levels between humans and their ape ancestors may have been the reason for the difference in brain size of the early hominids.

- (c) Describe how the hominid brain differs from an ape brain. (2 marks)

- (d) Complete the table below showing the hominid feature and the advantage that the hominid feature has for a hominid way of life. (2 marks)

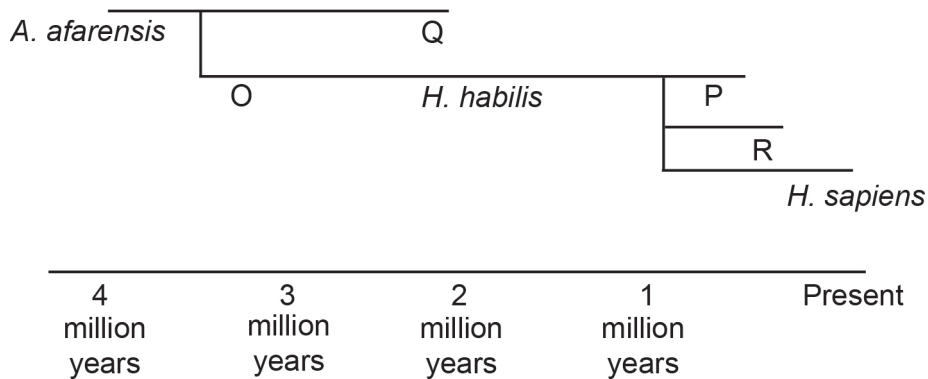
Hominid feature	Advantage for a hominid way of life
	Allows for precision grip and the fine manipulation of objects
Reduced prognathism	

Lovejoy and Raghanti also suggest that the different neurotransmitter levels may be linked to the development of language and more social behaviours, allowing humans to live in complex social groups.

The 'First Family' is a fossil find from Hadar, Ethiopia, that shows that early hominids did live in large social groups. The fossils that were dated at 3.2 million years ago and, classified as *Australopithecus afarensis*, included up to 17 different individuals.

- (e) Features of the fossil remains of the *Australopithecus afarensis* species include a broad, shallow pelvis, long, curved fingers, a carrying angle of the femur present and a highly mobile shoulder joint. On the basis of these anatomical features, suggest how *Australopithecus afarensis* may have lived. (3 marks)

Below is a phylogenetic tree diagram for one possible evolutionary relationship between *Australopithecus afarensis* and other hominid species.



- (f) Complete the table below on the basis of the information presented in the phylogenetic tree above. (3 marks)

Most likely species shown in phylogenetic tree	Identify species using letters 'O', 'P', 'Q' or 'R'
<i>Homo neanderthalensis</i>	
<i>Paranthropus robustus</i>	
<i>Australopithecus africanus</i>	

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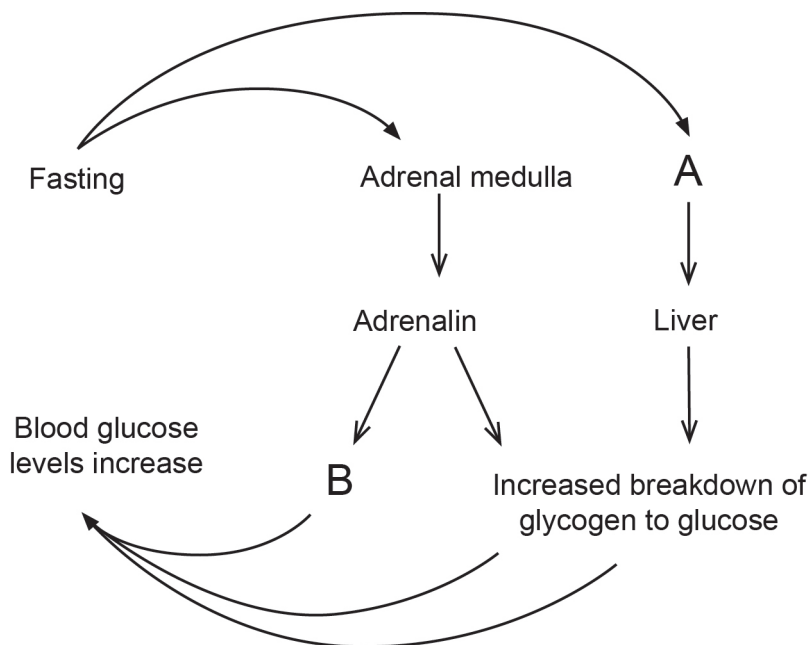
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Question 35

(12 marks)

Before any medical operation involving anaesthetics, individuals are asked to fast (not eat or drink) from at least midnight on the evening before the operation.

The diagram below shows some of the effects of fasting on blood sugar levels.



(a) (i) In the diagram above, what would structure A be? (1 mark)

(ii) In this scenario, structure A releases a hormone that acts on the liver. What name is given to this hormone? (1 mark)

(iii) Adrenalin acts on many structures to help increase blood sugar levels. What process is occurring at B that would contribute to the raising of blood sugar levels? (1 mark)

(iv) What other endocrine gland not shown in the diagram above could possibly be involved in maintaining blood sugar levels? (1 mark)

See next page

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The dawn phenomenon is a normal, natural rise in blood sugar that occurs in the early morning hours, between roughly 4 am and 8 am. The rise in blood sugar is normally handled with hormones and a healthy person will feel no effects. People with diabetes, however, feel the effects of having high sugar levels in their blood.

- (b) To help lower blood sugar levels, a series of processes occurs in various effectors. Define each of the following terms and name the structures in which each process occurs. (4 marks)

Process	Definition	Structure/s
Glycogenesis		
Lipogenesis		

- (c) Explain why a person with diabetes would feel the effects of high blood sugar, such as tiredness and excessive thirst. (4 marks)

Question 36

(12 marks)

Evolution of a species can occur through either genetic drift or natural selection.

The evolution of hominids probably occurred through the process of natural selection as the environment around them changed.

- (a) Describe mechanisms underpinning the theory of natural selection that produce changes in a gene pool, leading to speciation. (5 marks)

Genetic drift is another evolutionary mechanism that can cause a change in gene pools.

- (b) What is random genetic drift? (2 marks)

Nigeria has the highest incidence of children born with sickle-cell anaemia, which can cause premature death.

- (c) Explain, using the most likely scenario (random genetic drift or natural selection), how sickle-cell anaemia became common in Nigeria. (5 marks)

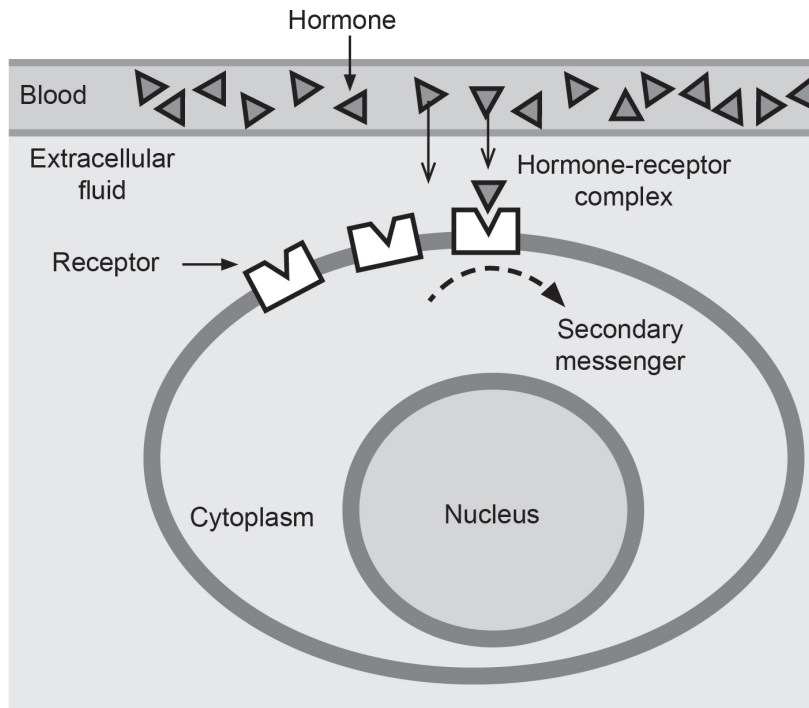
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Question 37

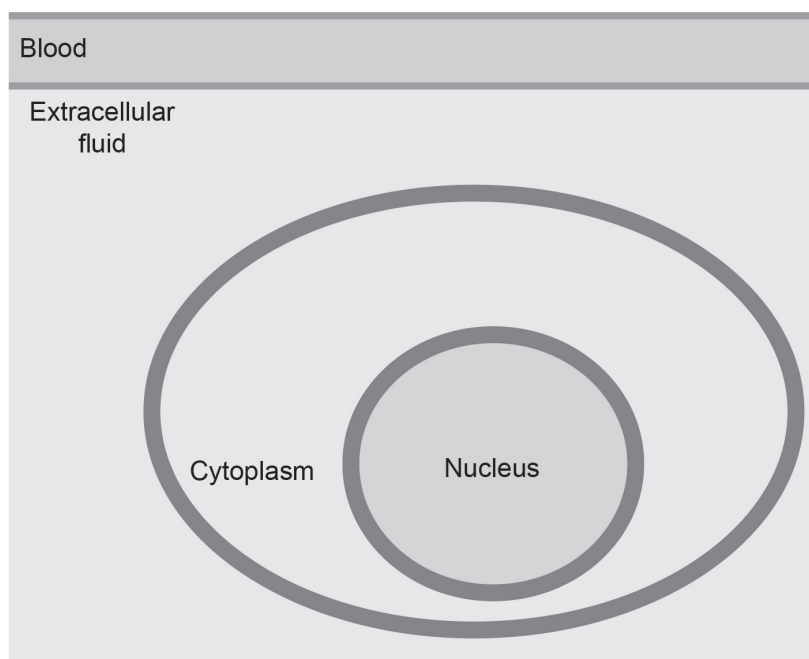
(13 marks)

The diagram below shows one type of hormonal mode of action.



- (a) (i) Is the diagram above a representation of the mode of action of a lipid-soluble or a water-soluble hormone? (1 mark)

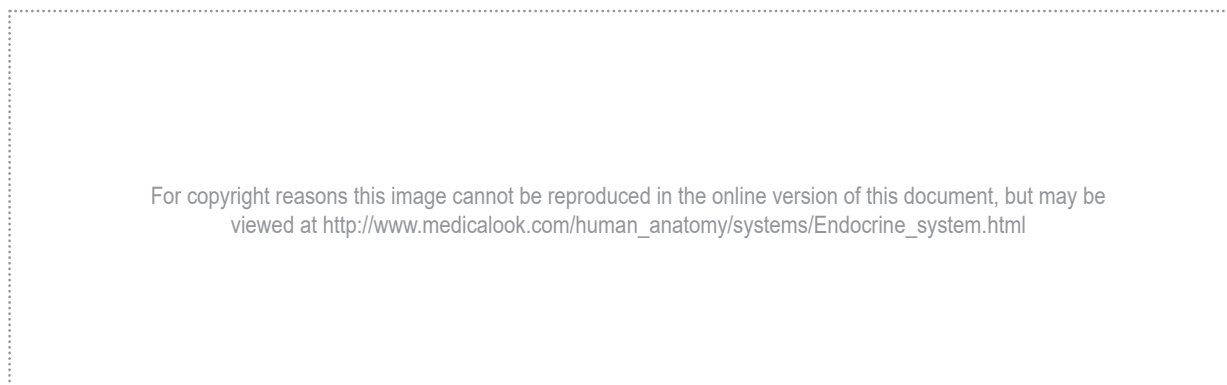
- (ii) In the outline below, draw an annotated diagram of the mode of action of the other type of hormone not shown in the diagram above. (4 marks)



See next page

Question 37 (continued)

The diagram below shows the glands of the endocrine system.



- (b) Using the information in the diagram, identify the appropriate gland using letters 'A'–'I' in the table below. (3 marks)

Description	Letter
the pineal gland is	
aldosterone is released from	
hormones released from this gland target the bones	

See next page

- (c) (i) State the type and the location of the receptors that detect changes which stimulate the production and release of antidiuretic hormone (ADH). (2 marks)

- (ii) Explain how the structures labelled 'B' and 'C' in the diagram on the previous page are involved in the production and release of ADH. (3 marks)

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Question 38

(12 marks)

An investigation was carried out into the effectiveness of a new asthma bronchodilator, to be used to increase the oxygen concentration in the blood of patients suffering from chronic asthma.

Two groups of patients suffering from chronic asthma were treated: group 1 received the new asthma bronchodilator and group 2 a placebo. The base level of oxygen concentration in the blood of the patients in the two groups was measured daily over a period of two weeks prior to the trial.

All patients in both groups began with a similar blood oxygen concentration of 94%, which was 4% lower than normal blood oxygen concentration. After three weeks of the trial, patients in group 1 had an average oxygen concentration of 98%, while group 2 still had an average blood oxygen concentration of 94%.

- (a) Suggest a hypothesis that this experiment was designed to test. (1 mark)

- (b) Name the independent and dependent variables. (2 marks)

- (c) Why was a placebo used for group 2 participants? (1 mark)

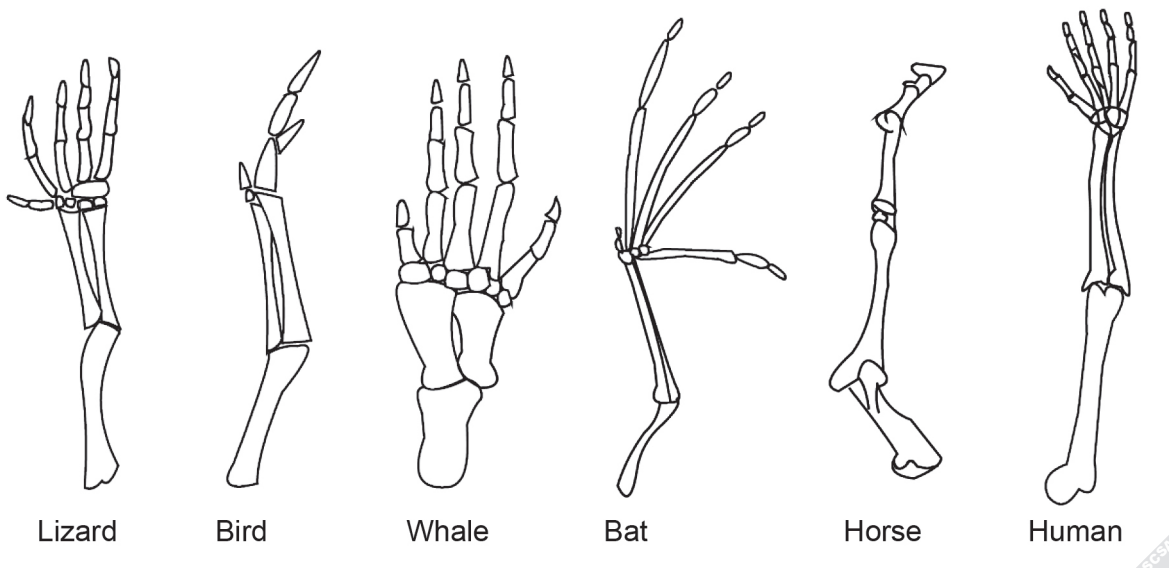
- (d) State **three** variables that would need to be controlled to ensure that the experiment was a fair trial. (3 marks)

See next page

Question 39

(11 marks)

The diagram below shows the bone structure in the limbs of six vertebrate species.



- (a) What name is given to this type of evidence for evolution? Describe how it provides evidence for evolution. (3 marks)

- (b) According to the theory of evolution, why are these six limbs similar and why are they different? (2 marks)

(c) If fossilised specimens of a new vertebrate organism displaying a similar limb structure were found, they would need to be dated. It was suggested that radiocarbon dating would be a good technique to provide an age for the fossil.

(i) State **one** condition under which it would be suitable to date the vertebrate specimen using radiocarbon dating, and **one** condition under which it would be unsuitable. (2 marks)

(ii) Describe the process of radiocarbon dating. (4 marks)

End of Section Two

See next page

DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

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

This section contains **three** questions. You must answer **two** questions. Write your answers on the pages following Question 42.

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.

Answer any **two** questions from Questions 40 to 42.

Indicate the questions you will answer by ticking the box next to the question. Write your answers on the pages that follow.

Question 40**(20 marks)**

A theory known as the 'hygiene hypothesis' seeks to explain how children are developing allergies that can lead to anaphylaxis or a greatly increased susceptibility to disease. The hygiene hypothesis states that the increased incidence of children with allergies is due to our improved hygiene practices and improved standard of living.

Note: The definition of hygiene is any practice or activity that you do to keep yourself and your surroundings healthy and clean.

- (a) Describe the process involved in the body developing immunity to a certain bacteria or virus. (16 marks)
- (b) Provide the logical reasoning that led scientists to develop the 'hygiene hypothesis'. (4 marks)

Question 41**(20 marks)**

Mutations in the human genome can result from a variety of different causes. For each of the scenarios below explain how mutations are caused and the types of mutations produced. Provide an example of each to help clarify your answer.

- (a) Errors in DNA replication (7 marks)
- (b) During cell division (7 marks)
- (c) From damage caused by mutagens (6 marks)

See next page

**Question 42****(20 marks)**

In 1856, workmen in a cave in the Neander valley in Germany discovered a set of bones. Normally only small fragments of bones are found as fossils, so this discovery of 16 pieces of the same skeleton was unusual. This specimen was given the name *Homo neanderthalensis*.

- (a) Much of the fossil record is incomplete. Explain why this is so and why it cannot represent the entire biodiversity of a time. (8 marks)
- (b) Mitochondrial DNA (mtDNA) samples have been extracted from *Homo neanderthalensis* fossils and compared with those of modern humans. The focus was on differences in mtDNA to determine whether speciation had in fact taken place. Describe how the study of mtDNA can be used to support the theory of evolution and the relationship between *Homo neanderthalensis* and modern humans. (4 marks)

While fossil and artefact finds are limited, they can be used to show changes in both anatomy and culture.

- (c) (i) Name and describe what tools found near *Homo neanderthalensis* bones would have looked like. (4 marks)
- (ii) State how the tools would have been manufactured and what they would imply about the way in which *Homo neanderthalensis* lived. (4 marks)

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End of questions

ACKNOWLEDGEMENTS

- Question 10** Graph adapted from: Mysid. (2006). *Population bottleneck* [Graph]. Retrieved April, 2018, from https://commons.wikimedia.org/wiki/File:Population_bottleneck.svg Used under the Creative Commons Attribution-Share Alike 3.0 Unported licence.
- Questions 14–15** Adapted from: Lawson, R. (2007). [Diagram of cross-section of spinal cord]. Retrieved April, 2018, from http://wikieducator.org/Nervous_System_Worksheet Used under the Creative Commons Attribution-Share Alike 3.0 Unported Licence.
- Questions 17–18** Diagram adapted from: *Close-up view of the meninges surrounding the brain*. (n.d.). Retrieved April, 2018, from <https://www.neuroscientificallychallenged.com/blog/know-your-brain-meninges>
- Question 21** Diagram 1 adapted from: Potter, J. (2006). [...] *cranial anatomy*. Retrieved April, 2018, from, [https://commons.wikimedia.org/wiki/File:\[...\]_cranial_anatomy.jpg](https://commons.wikimedia.org/wiki/File:[...]_cranial_anatomy.jpg) Used under the Creative Commons Attribution-Share Alike 2.5 Generic licence.
Diagrams 2–4 adapted from: Victorian Curriculum and Assessment Authority. (2015). [Images of fossil hominin skulls]. Retrieved April, 2018, from <http://www.vcaa.vic.edu.au/Documents/exams/biology/2015/2015biology-cpr-w.pdf>
- Questions 23–24** Diagram from: University of Waikato, Science Learning Hub. (2007–2011). *Using [...]*. Retrieved April, 2018, from <https://www.sciencelearn.org.nz/resources/1485-relative-dating>
- Question 31** Diagram adapted from: Gorton, N. (2012). [...] *neurons*. Retrieved April, 2018, from [https://commons.wikimedia.org/wiki/File:\[...\]_neurons.PNG](https://commons.wikimedia.org/wiki/File:[...]_neurons.PNG)
- Question 34** Lovejoy and Raghanti information from: Stetka, B. (2018). Cocktail of brain chemicals may be a key to what makes us human. *Scientific American*. Retrieved April, 2018, from <https://www.scientificamerican.com/article/cocktail-of-brain-chemicals-may-be-a-key-to-what-makes-us-human/>
- Question 35(b)** Adapted from: Fletcher, J. (2017). How to control dawn phenomenon. *Medical News Today*. Retrieved April, 2018, from <https://www.medicalnewstoday.com/articles/317351.php>
- Question 37(b)** Diagram adapted from: *Endocrine system*. (n.d.). Retrieved April, 2018, from http://www.medicallook.com/human_anatomy/systems/Endocrine_system.html

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