



Western Australian Certificate of Education Examination, 2013

Question/Answer Booklet

HUMAN BIOLOGICAL SCIENCE

Stage 3

Please place your student identification label in 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 for paper: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer Booklet
Multiple-choice Answer Sheet

Number of additional answer booklets used (if applicable):

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 the WACE examinations

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 notes or other items of a non-personal nature in the examination room. 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 exam
Section One: Multiple-choice	30	30	40	30	30
Section Two: Short answer	9	9	90	100	50
Section Three: Extended answer	3	2	50	40	20
Total					100

Instructions to candidates

- The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2013*. Sitting this examination implies that you agree to abide by these rules.
- 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. 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.

Sections Two and Three: Write your answers in this Question/Answer Booklet.

- You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
- Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
 - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
 - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the 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. 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. Symptoms of a person with damage to their cerebellum would include
 - (a) loss of memory.
 - (b) uncoordinated movements.
 - (c) vision impairment.
 - (d) inability to feel pain.

2. Which of the following does **not** describe a feature displayed by a primitive primate when being compared with a more advanced primate?
 - (a) smaller cranial capacity relative to body size
 - (b) shorter gestational period
 - (c) greater reliance on vision than sense of smell
 - (d) greater number of teeth

3. The range of movement permitted at a pivot joint includes
 - (a) rotation.
 - (b) flexion and extension.
 - (c) abduction and adduction.
 - (d) circumduction.

4. A small island called Pingelap, located in the West Pacific, has a large proportion of individuals with complete achromatopsia. The condition results in total colour blindness, with sufferers only able to see in black, grey and white. The condition is very rare in most populations, but in Pingelap one in every 20 people is afflicted. The start of the high incidence of the condition in Pingelap can be dated back to a typhoon in 1775 that killed much of the population.

Which of the following statements is the **most** likely explanation for the high incidence of total colour blindness in the current Pingelap population?

 - (a) Natural selection pressures were altered by the typhoon and now must favour total colour blindness in Pingelap.
 - (b) Mutation rates are very high in Pingelap, causing numerous new cases of the condition in every generation.
 - (c) The original migrating population had a high incidence of the condition and it has been passed on from generation to generation.
 - (d) Random genetic drift must have occurred when the population numbers were reduced by the typhoon.

See next page

Questions 5 and 6 refer to the diagram below.

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5. Which of the following describes correctly what is occurring at X and Y?

	X	Y
(a)	Transcription at the ribosome	Translation in the nucleus
(b)	Translation at the ribosome	Transcription in the nucleus
(c)	Translation in the nucleus	Transcription at the ribosome
(d)	Transcription in the nucleus	Translation at the ribosome

6. The structure labelled 'Z'

- (a) carries an amino acid to the mRNA.
- (b) is the start codon that triggers the joining of amino acids.
- (c) creates a protein by forming peptide bonds.
- (d) contains three bases of mRNA that code for an amino acid.

See next page

7. The hormone that influences ovulation **most** directly is
- (a) progesterone.
 - (b) follicle stimulating hormone.
 - (c) luteinising hormone.
 - (d) oestrogen.
8. A lack of Vitamin D is common among people originally from locations of high UV radiation who move to locations of low UV radiation. This is due to a lack of penetration of UV radiation into their cells to enable the production of Vitamin D.

The reason for this is that, by comparison with other people, they have

- (a) higher levels of melanin pigment in their skin.
- (b) higher numbers of melanocytes in their skin.
- (c) smaller and more evenly distributed melanosomes in their skin.
- (d) a different enzyme controlling the production of melanin.

Questions 9 and 10 refer to the diagrams below.

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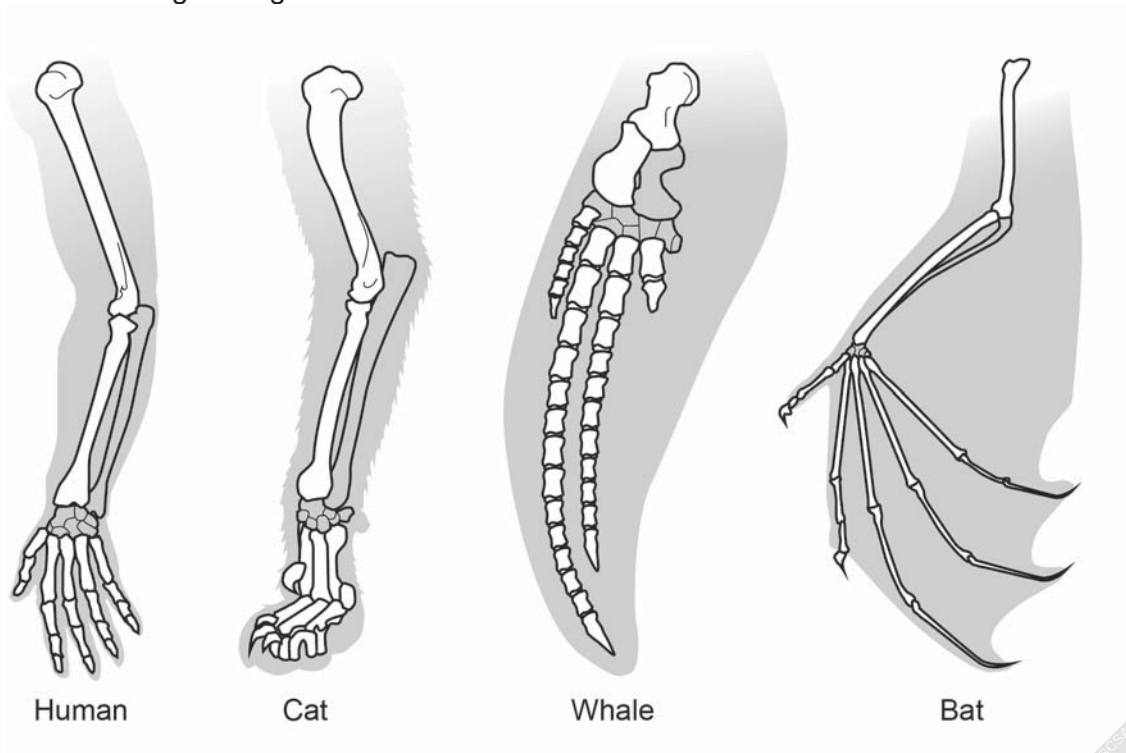
9. The marmoset cannot hold the object in the same way as the other two primates because its
- (a) hand is lacking a fifth digit.
 - (b) hand and fingers are not prehensile.
 - (c) fingers are not long enough to grasp the object fully.
 - (d) fingers are clawed, which limits the grasping action.
10. The macaque and the chimpanzee show an action of grasping that is typical of primates. Which of the following primate features allows for this grasping by the hands?
- (a) pentadactyl limb
 - (b) precision grip
 - (c) opposable thumb
 - (d) unspecialised hand

See next page

11. Alzheimer's and Parkinson's are both diseases affecting the central nervous system and they share some similar characteristics. Which of the following is **only** true for Alzheimer's disease?

- (a) Patients suffer from the degeneration of nerve cells in the brain.
- (b) Symptoms can be treated with medications that increase acetylcholine in the brain.
- (c) It mostly affects people over the age of 55 and presently has no cure.
- (d) Patients lack a neurotransmitter essential for normal brain functioning.

12. The diagram below shows the limbs of different vertebrates. These limbs are described as homologous organs.



The differences between these limbs shows that

- (a) changes due to genetic drift have occurred over a long period of time.
 - (b) variations in structure have evolved from a common ancestor.
 - (c) structures have evolved from different ancestors existing in similar environments.
 - (d) different structures have been acquired to suit different environments.
13. Sickle-cell anaemia is a condition prevalent in some populations. The **best** explanation as to why this occurs is
- (a) Founder effect: Original migrating populations had a high incidence of the allele, which has been maintained over successive generations.
 - (b) Genetic drift: Affected populations tend to be small and isolated, thus increasing the chance of changes in allele frequencies.
 - (c) Heterozygote advantage: Carriers of the allele have a survival advantage, so the allele is maintained in the population due to natural selection.
 - (d) Barriers to gene flow: Cultural differences between populations limit interbreeding, causing the allele frequency to be maintained.

Questions 14 and 15 refer to the information and graphs below.

Two recording electrodes labelled '1' and '2' were used to measure nerve impulses when a neuron was stimulated. The impulse generated by the stimulation of a neuron at three different voltages 'P', 'Q' and 'R' is shown by the traces on the graphs, as the action potential passes Points 1 and 2.

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14. The impulse generated is
- (a) greater at Voltage P than at Voltage Q.
 - (b) greater at Voltage R than at Voltage Q.
 - (c) the same at Voltage Q and Voltage R.
 - (d) the same at Voltage P and Voltage R.
15. By referring to the graphs, determine which of the following statements is correct.
- (a) A particular voltage has to be reached before an impulse is generated.
 - (b) The size of an impulse will always be the same, regardless of the voltage.
 - (c) Increasing the voltage will generate more impulses.
 - (d) The higher the voltage, the stronger an impulse will be.

See next page

16. During protein synthesis, for transcription to take place, a particular enzyme must bind to a specific sequence of DNA that regulates gene expression and is on the same DNA strand as the gene that is to be transcribed.

The enzyme and the specific sequence of DNA are called, respectively,

- (a) RNA polymerase and a promoter gene.
 - (b) RNA polymerase and a regulator gene.
 - (c) DNA polymerase and a promoter gene.
 - (d) DNA polymerase and a regulator gene.
17. *Staphylococcus aureus* is a bacterium that is a common cause of skin infections. It was previously killed by the antibiotic methicillin. However, a strain of *Staphylococcus aureus* is now resistant to this antibiotic.

Which of the following statements **best** explains how methicillin-resistant *Staphylococcus aureus* originated?

- (a) Methicillin directly caused mutations in the bacterial DNA, resulting in some bacteria that were resistant to the drug.
 - (b) Changes in the bacterial DNA sequence by chance produced a strain resistant to methicillin.
 - (c) Bacteria with resistance to methicillin survived due to natural selection.
 - (d) Genetic drift caused more bacteria with resistance to survive, creating a methicillin-resistant population.
18. As a result of disease, a male has suffered damage to his brain. This damage has caused him to be unable to feel full when eating. He eats such large amounts that he is now classified as being obese. The part of his brain **most** likely to have been damaged is his
- (a) hypothalamus.
 - (b) cerebral cortex.
 - (c) medulla oblongata.
 - (d) cerebellum.

19. Although hormones and nerves both control homeostasis, they act in different ways.

Which of the following is correct?

- (a) Hormonal action is controlled from one central source, whereas nervous action has several control centres.
- (b) Nervous control involves electrochemical changes, whereas hormonal control only involves electrical changes.
- (c) Responses to stimuli by nervous control are much faster than responses by hormonal control.
- (d) Effects produced by nervous control are longer lasting than those produced by hormonal control.

Questions 20 and 21 refer to the diagram below.

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20. The sections of the nephron tubule labelled 'W', 'X', 'Y' and 'Z' are

	W	X	Y	Z
(a)	proximal convoluted tubule	collecting duct	distal convoluted tubule	loop of Henle
(b)	distal convoluted tubule	collecting duct	proximal convoluted tubule	loop of Henle
(c)	distal convoluted tubule	loop of Henle	proximal convoluted tubule	collecting duct
(d)	proximal convoluted tubule	loop of Henle	distal convoluted tubule	collecting duct

21. Control of water loss from the kidney occurs in different parts of the nephron tubule. However, water regulation is initiated in different ways. The first of these occurs in W and X and the second in Y and Z.

Which of the following is correct?

- (a) In W and X, the hormone ADH controls the water loss by changing the concentration of solutes.
- (b) In Y and Z, the hormone ADH controls the water loss by changing the permeability of the tubule wall.
- (c) In Y and Z, the reabsorption of solutes creates an osmotic gradient so water moves out of the filtrate.
- (d) In W and X, the secretion of solutes into the tubule creates an osmotic gradient so water moves into the tubule.

See next page

22. Which of the following is an example of passive natural immunity?
- (a) The body manufactures antibodies in response to an invading pathogen.
 - (b) Antibodies enter the blood stream via an injection of antitoxin.
 - (c) Antibodies enter the blood stream from mother to foetus across the placenta.
 - (d) The body manufactures antibodies after an injection of toxoids.
23. Which of the following differentiates correctly between antibiotics and vaccines?
- (a) Antibiotics provide long-lasting immunity due to the production of memory cells, while vaccines only provide short-term immunity.
 - (b) Antibiotics treat for an invading pathogen, while many vaccines involve the introduction of an inactivated pathogen into the bloodstream.
 - (c) Antibiotics provide artificial, active immunity, while vaccines provide artificial, passive immunity.
 - (d) Antibiotics are often injected into the bloodstream, while vaccines are normally ingested in pill form.

Question 24 refers to the diagram below, which illustrates research being conducted into the potential to grow new heart valves for patients with defective ones.

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24. This type of medical biotechnology would be **best** described as
- (a) cell replacement therapy.
 - (b) recombinant DNA technology.
 - (c) gene therapy.
 - (d) tissue engineering.

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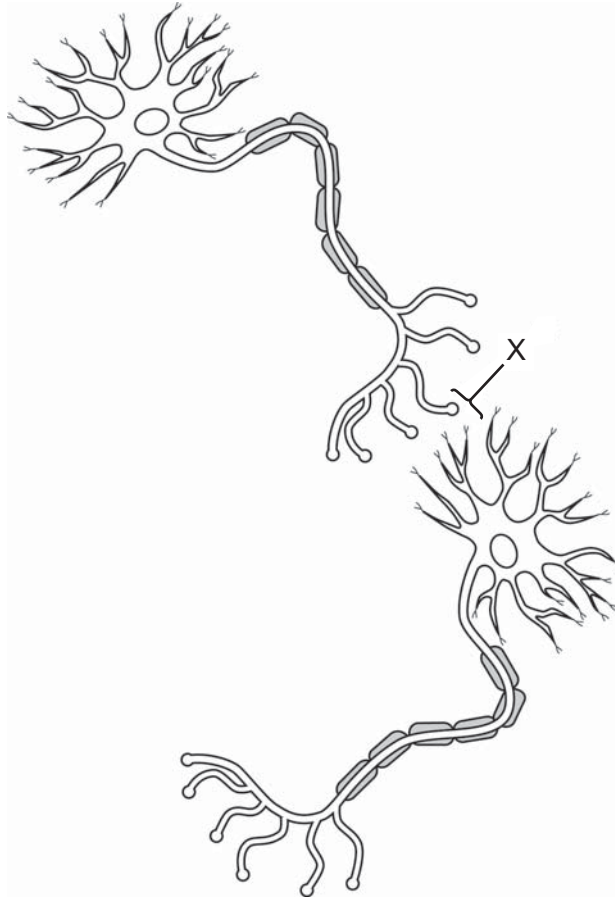
25. The bionic eye is classified as a type of artificial replacement that can be used to treat a patient suffering from blindness. Which of the following would also be classified as an artificial replacement?
- (a) lung transplant for a patient suffering from lung disease
 - (b) lower leg prosthesis for a patient who has had a leg amputated
 - (c) genetically engineered spray-on skin for a patient with severe burns
 - (d) tissue graft in the knee of a patient with a torn ligament
26. A student examining a slide of muscle tissue under the microscope saw the presence of striations and intercalated discs. The type of muscle he was looking at was
- (a) cardiac.
 - (b) skeletal.
 - (c) smooth.
 - (d) tendon.

Questions 27 and 28 refer to the information below.

Thyroxine is secreted by the thyroid gland to control metabolic rate. In a person with a defective thyroid gland, this secretion will be outside the normal range.

27. In a person with normal thyroid function, low levels of thyroxine in the blood would result in
- (a) increased metabolic rate and would involve feedback from the anterior pituitary.
 - (b) increased metabolic rate and would involve feedback from the posterior pituitary.
 - (c) decreased metabolic rate and would involve feedback from the anterior pituitary.
 - (d) decreased metabolic rate and would involve feedback from the posterior pituitary.
28. People with abnormally high levels of thyroxine would
- (a) lose weight and suffer from a condition known as hypothyroidism.
 - (b) lose weight and suffer from a condition known as hyperthyroidism.
 - (c) gain weight and suffer from a condition known as hypothyroidism.
 - (d) gain weight and suffer from a condition known as hyperthyroidism.
29. Which of the following statements relating to the myelin sheath is **incorrect**?
- (a) In the peripheral nervous system, myelin is formed by Schwann cells.
 - (b) Myelin is mainly composed of lipids, proteins and water.
 - (c) Some fibres in the central nervous system are unmyelinated.
 - (d) Myelin provides an insulating sheath around a whole nerve.

Question 30 refers to the diagram below.



30. The region labelled 'X' represents a
- (a) ganglion.
 - (b) node of Ranvier.
 - (c) neuromuscular junction.
 - (d) synapse.

End of Section One

See next page

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Section Two: Short answer

50% (100 Marks)

This section has **nine (9)** questions. Answer **all** questions. Write your answers in the spaces provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare page for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 90 minutes.

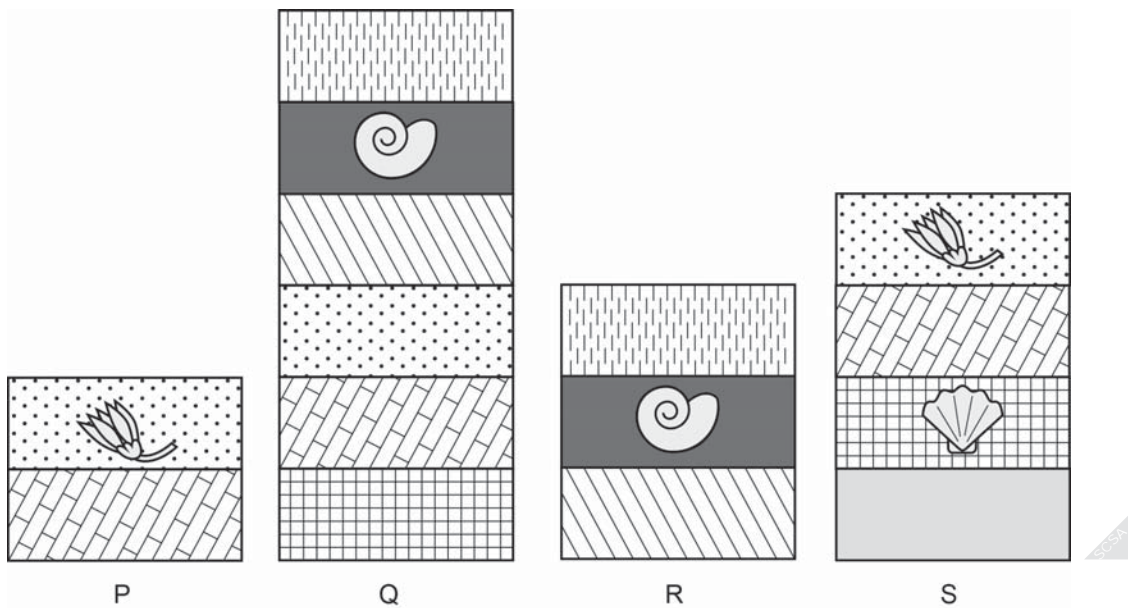
Question 31

(10 marks)

(a) State the name given to the study of rock layers.

(1 mark)

Part (b) of the question refers to the diagram below, which shows rock strata from four different locations labelled 'P', 'Q', 'R' and 'S'. Some of the strata contain fossils.



(b) Using the diagram above, complete the following questions.

(i) Which location contains the oldest layer? Justify your answer.

(2 marks)

- (ii) Some of the fossils found in the rock strata can be seen in more than one location and help to provide a more precise correlation between the rock strata in different locations. State the name given to these types of fossils. (1 mark)

- (c) The fossil record shows all of the fossil evidence that has been found in the earth's strata. However, many gaps exist in the fossil record. One of the main reasons for the gaps is that fossil formation is a rare event.

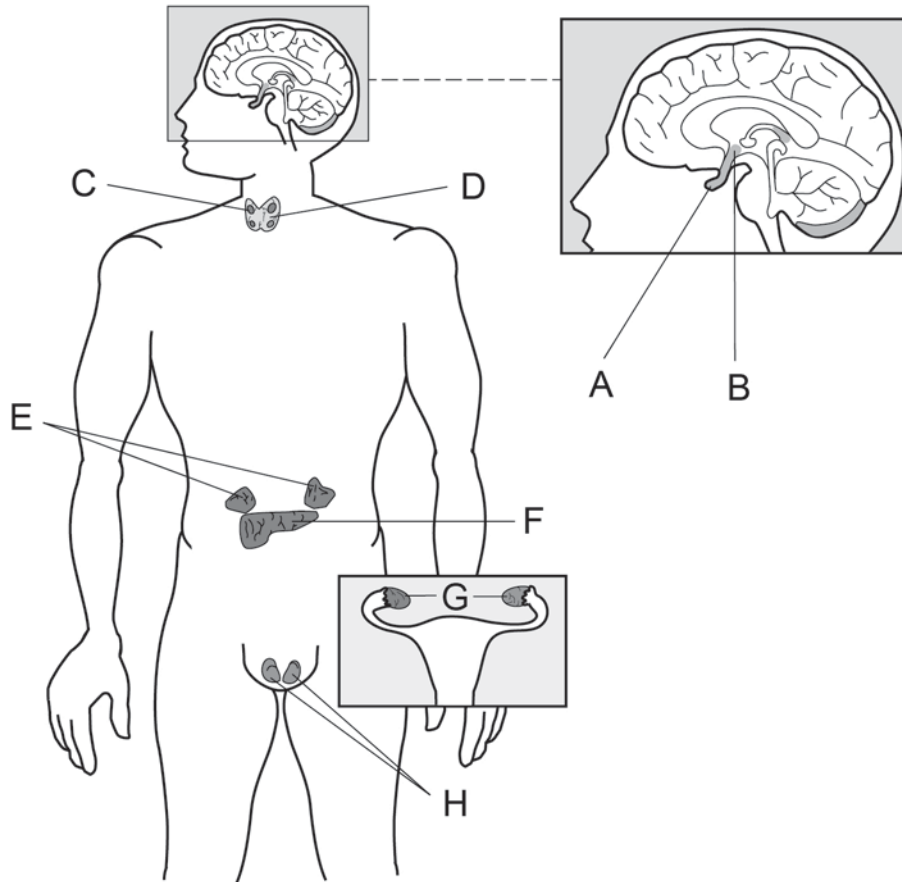
- (i) Outline **four** unique conditions needed for fossil formation to occur. (4 marks)

- (ii) State **two** reasons, apart from a lack of fossil formation, that explain why there are gaps in the fossil record. (2 marks)

Question 32

(11 marks)

Parts (a) and (b) of the question refer to the diagram of endocrine glands below.



(a) Identify the endocrine gland that

(i) secretes the hormone aldosterone. (1 mark)

(ii) secretes a hormone that targets bone. (1 mark)

(b) Describe the role of each of the following structures in the regulation of body fluid composition. (2 marks)

A: _____

B: _____

Hormones can be grouped into two different categories based on their mode of action when they reach a target cell.

Parts (c), (d) and (e) of the question refer to the diagram below, which represents the mode of action of one of the categories of hormone.

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(c) Using the diagram above, complete the following questions.

(i) Name the category of hormones this diagram represents. (1 mark)

(ii) At Point 1, what feature of the cell membrane enables the hormone to cross into the cytoplasm? (1 mark)

(d) Describe what is occurring at Points 2–5. (4 marks)

2	
3	
4	
5	

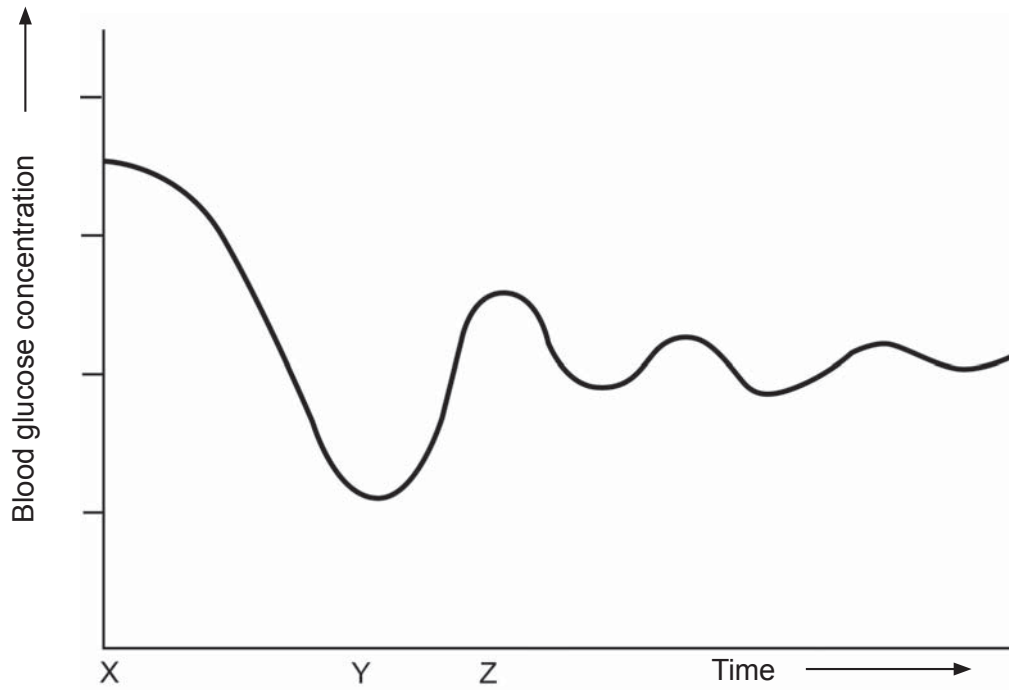
(e) The mode of action of the other category of hormones differs from the mode of action shown in the diagram. Identify **one** characteristic of the other category of hormones that makes it unique. (1 mark)

Question 33

(12 marks)

The following question refers to the information and graph below.

Prior to having a morning operation, a patient was told to fast (go without food) after an evening meal the night before. The graph below shows changes in the blood glucose concentration throughout the night, while the patient was resting, starting 30 minutes after the evening meal.



- (a) Describe how the above graph illustrates a negative feedback model. (2 marks)

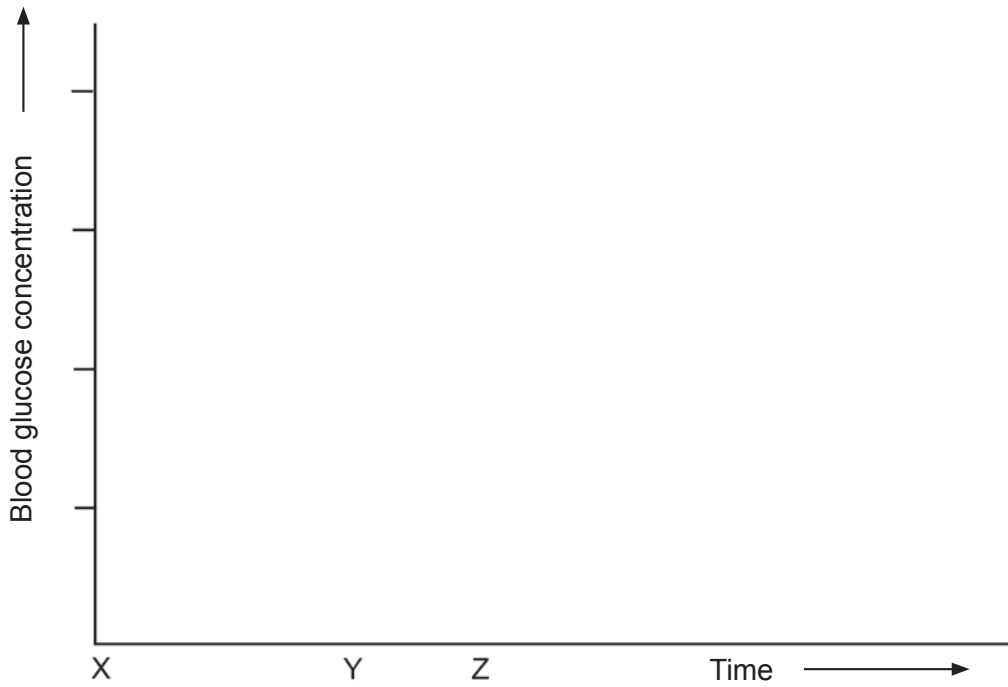
- (b) The following questions refer to the change in blood glucose concentration between Points Y and Z on the graph.

- (i) Name the hormone that caused the change in blood glucose concentration between times Y and Z on the graph. (1 mark)

- (ii) Name the cell type and the specific location within the organ from which the hormone stated in part (b) (i) was secreted. (2 marks)

- (iii) Describe **two** responses that led to the change in blood glucose concentration between times Y and Z on the graph. (2 marks)

- (c) (i) On the axes below, draw the blood glucose levels of a person suffering Type 2 diabetes (untreated) over this same time period. (1 mark)



- (ii) Explain the shape of your graph above in terms of glucose regulation. (4 marks)

Question 34

(11 marks)

- (a) Polymerase chain reaction (PCR) is a biotechnological technique used when only very small amounts of DNA are available for sampling. Describe **three** situations in which PCR would be useful. (3 marks)

- (b) There are several steps in a single cycle of PCR. The first involves the denaturing of DNA. State the purpose of the first step in the process and how it is achieved. (2 marks)

- (c) After the DNA is denatured, the next step in the cycle of PCR involves primers. Explain the purpose of primers in PCR. (2 marks)

- (d) The Human Genome Project has made it possible to target disease-causing genes by using genetic probes.

- (i) Describe a genetic probe. (2 marks)

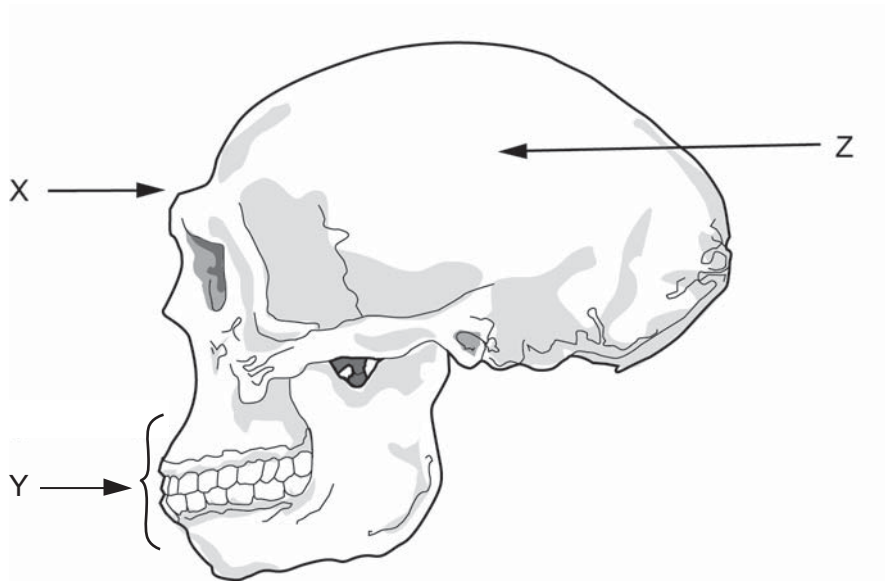
- (ii) A sample of DNA is being tested for Huntington's disease, a genetic disorder in which the base sequence of the gene is known.

Explain how a probe would be used to detect the abnormal gene. (2 marks)

Question 35

(12 marks)

Part (a) of the question refers to the diagram of a *Homo erectus* skull below.



- (a) For each of the parts identified in the diagram of the *Homo erectus* skull, describe how the skull of a typical modern *Homo sapiens* differs from that shown in the diagram and give **one** advantage for *Homo sapiens* for each change. (6 marks)

	How the skull of a typical modern <i>Homo sapiens</i> differs	Advantage
X		
Y		
Z		

(b) Archaeologists are studying evidence collected from a fossil dig. They believe the fossil remains belong to *Homo erectus* and have dated the age of the site at approximately 1.1 million years. The archaeologists are searching for more evidence to support their theory.

(i) Identify **two** pieces of evidence, not including the skeletal remains, that archaeologists might find at the site. For each, propose the cultural behaviour associated with *Homo erectus* that the evidence suggests. (4 marks)

Archaeological evidence	Cultural behaviour

(ii) Would carbon-14 dating be a suitable technique for dating the *Homo erectus* fossil? Justify your answer. (2 marks)

Question 36

(13 marks)

A recent study investigated the effects of MDMA (ecstasy) on human thermoregulation. The research team selected 10 individuals (male and female) aged between 18 and 35 years. Each participant attended two sessions, one week apart. At the first session participants received, in tablet form, either a placebo or 2 mg/kg of MDMA. If at the first session participants received a placebo, at the second session they received MDMA, and vice versa.

At each session, participants assembled in a room at 10 am with the room temperature at 23 °C. After 30 minutes, the room temperature was changed to 30 °C, which took about 2 minutes. Data collection began at 11 am, when the drug or placebo tablet was given with a small amount of water. Recordings of core body temperature were taken every hour for the next 4 hours, with the session concluding at 3 pm.

Data for each of the **five** time periods were averaged and recorded (in order of time starting at 11am) in a notebook as follows:

MDMA: 36.9 °C, 37.1 °C, 37.5 °C, 37.6 °C, 37.6 °C

Placebo: 36.9 °C, 37.0 °C, 37.0 °C, 37.1 °C, 37.1 °C

(a) Present the above data in a table.

(5 marks)

- (b) Formulate a hypothesis for this experiment. (1 mark)

- (c) Explain why each participant did not receive the same amount of MDMA: that is, they received 2 mg of MDMA per kilogram of body mass of the participant. (1 mark)

- (d) (i) Describe **two** variables that were controlled adequately in the experiment. (2 marks)

- (ii) For **one** of the variables described in part (d) (i), explain why it needed to be controlled. (1 mark)

- (e) The research team also recorded the oxygen consumption of participants over the same time period. While they found that oxygen consumption after administration of the placebo remained constant, they found that it increased significantly after the administration of MDMA.

Using this information and data from the table, suggest what caused the observed effect of MDMA on core body temperature. (1 mark)

Question 36 (continued)

- (f) (i) During both sessions, the research team took recordings of skin temperature for 5 hours from 10 am. Between 10.30 am and 11 am, the skin temperature increased 1 °C prior to administration of the placebo and MDMA. Explain why this occurred.

(1 mark)

- (ii) After 12.30 pm, the skin temperature, following administration of MDMA, steadied at 0.5 °C above the skin temperature following administration of the placebo. Account for what might have caused the difference in skin temperatures between the two treatments.

(1 mark)

Question 37

(10 marks)

(a) Vertebrae are joined by cartilaginous joints.

(i) Name the type of cartilage that joins vertebrae to each other. (1 mark)

(ii) Describe how the structure of the cartilage referred to in part (a) (i) suits its function. (2 marks)

(b) With reference to the structure of both cartilage and bone, determine which would heal faster following injury. Justify your answer. (4 marks)

(c) Osteoarthritis is a condition that is more likely to occur as people age. Describe **three** effects of this condition. (3 marks)

Question 38

(8 marks)

(a) Outline what the study of epigenetics examines.

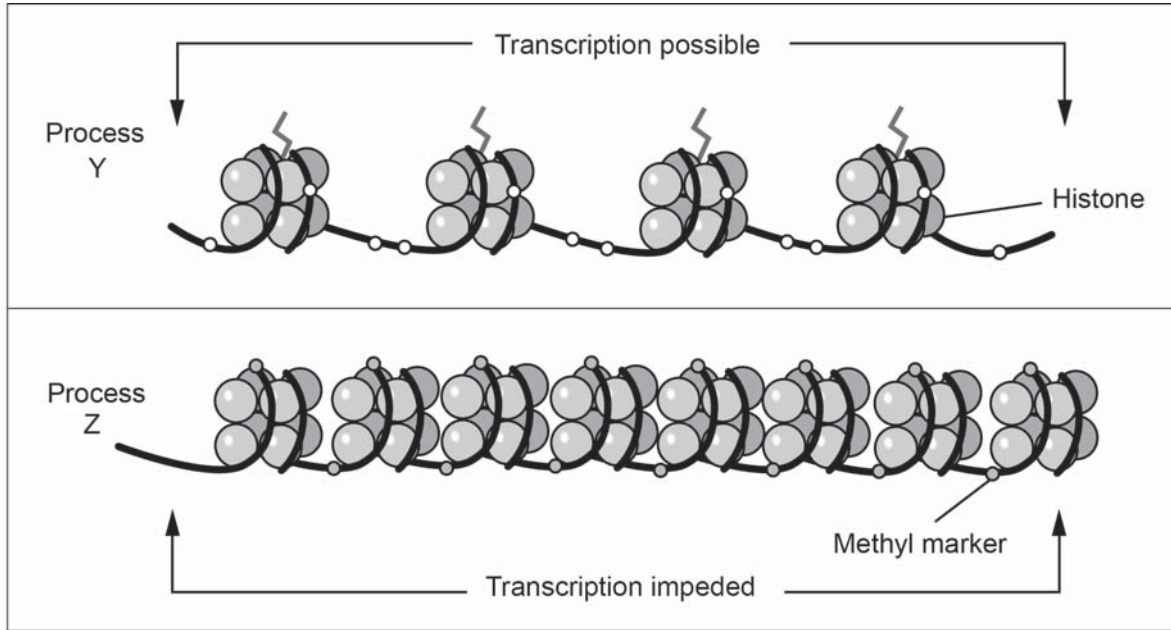
(1 mark)

(b) Seventeen-year-old identical twins, Adam and Michael, are both considered to be tall individuals: Adam is 192 cm and Michael is 188 cm.

(i) Height is a trait controlled by polygenes. Describe the genotype for height of Adam and compare it with the genotype for height of Michael. (2 marks)

(ii) Explain how the different heights of Adam and Michael can be attributed to epigenetics. (2 marks)

Part (c) of the question refers to the diagram below, which represents histone modification of DNA.

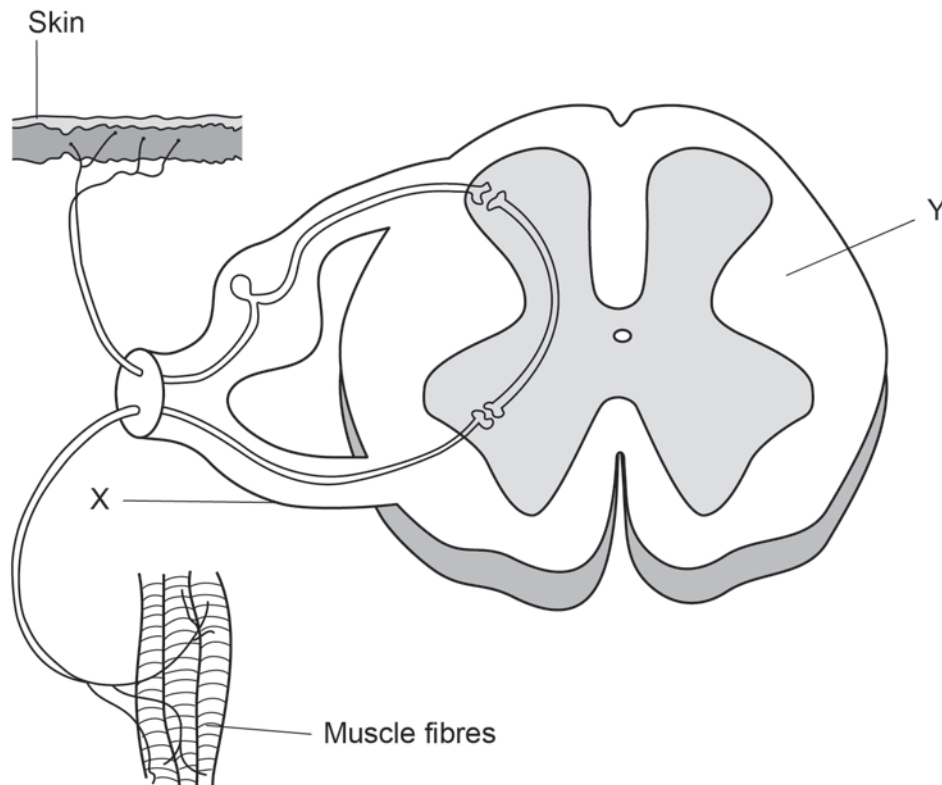


(c) Explain what is occurring in the process labelled 'Y' in the diagram. (3 marks)

Question 39

(13 marks)

Parts (a), (b) and (c) of the question refer to the diagram below, which shows a cross section of the spinal cord and components of a reflex arc.



(a) (i) Name the type of nerve fibres found in the root labelled 'X'. (1 mark)

(ii) Identify the area shown as 'Y'. (1 mark)

(b) The skin and muscle fibres shown in the diagram are associated with a reflex arc.

(i) Draw an arrow on the diagram to show the direction of a nerve impulse through this reflex arc. (1 mark)

(ii) State **three** important functional properties of reflexes. (3 marks)

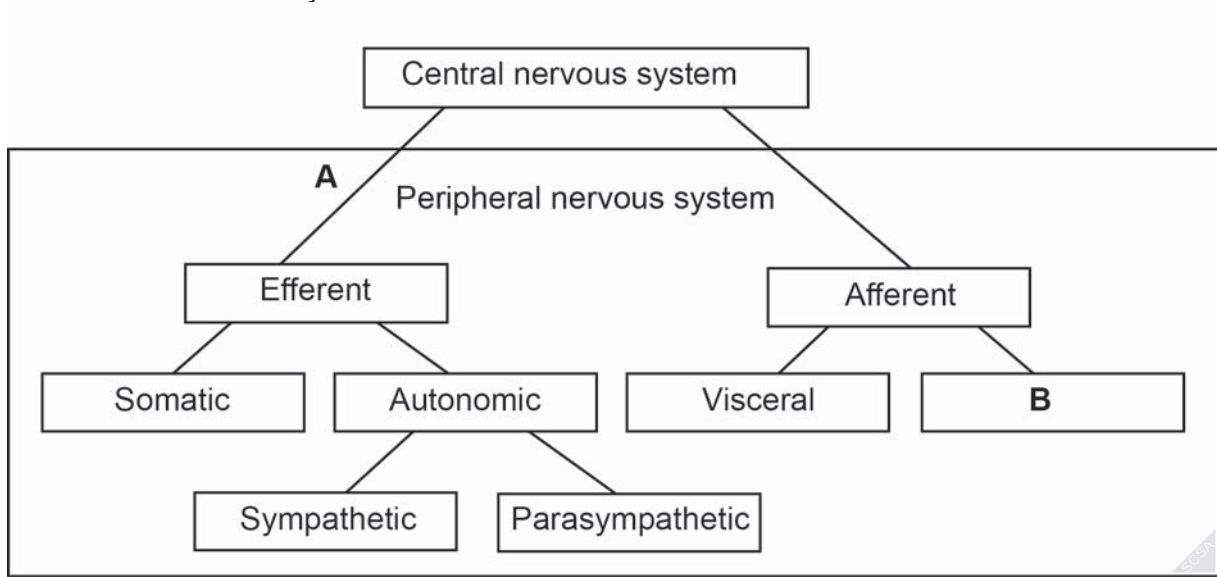
(iii) State a reason why reflex arcs are important. (1 mark)

(c) CIPA is a rare congenital disorder caused by a mutation that prevents the formation of nerve cells which are responsible for transmitting signals of pain.

Would these nerve cells be located closer to the skin or to the muscle fibres, as shown on the diagram? Explain your answer. (2 marks)

Question 39 (continued)

Part (d) of the question refers to the following diagram, which shows the organisation and divisions of the nervous system.



(d) Using the diagram above, complete the following:

(i) On the diagram, draw the head of an arrow on the line labelled 'A' to show the direction of impulses between the central and peripheral nervous systems. (1 mark)

(ii) Where is information communicated to and from by the division shown as 'B' in the diagram? (1 mark)

(iii) A medical condition called hyperhidrosis is caused by an over-activity of neurons sending impulses to the sweat glands. Symptoms of the condition are normally seen when a person feels nervous or stressed.

Identify the division of the peripheral nervous system that would be affected by this condition and the main symptom you would expect to see in sufferers. (2 marks)

End of Section Two

See next page

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

This section has **three (3)** questions. You must answer **two (2)** questions. Write your answers in the lined pages provided.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare page for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Responses may 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.

Suggested working time: 50 minutes.

Question 40**(20 marks)**

- (a) Outline the events involved in the nervous stimulation and subsequent contraction of skeletal muscle. In your answer include the role of calcium ions. (9 marks)
- (b) Explain how blood flow increases to working skeletal muscles during exercise. (11 marks)

Question 41**(20 marks)**

- (a) A student studying human evolution at university was presented with two partial primate skeletons. The only parts remaining of each skeleton were the feet and pelvis. The student was asked to examine each skeleton and decide which was a modern ape and which was an extinct hominin specimen of the genus *Homo*.

Select **five (5)** distinguishing features of the pelvis and foot that could be seen in the skeletons and explain how they differed between the two specimens. (10 marks)

- (b) Examining fossils and their surroundings is one method by which evolution can be shown to have occurred. However there are also many types of comparative studies that can be used to support the theory of evolution. Two of these involve studies in biochemistry, namely protein sequences and DNA.

Describe the two comparative studies of protein sequences and DNA, and explain how they show evidence for evolution. (10 marks)

Question 42

(20 marks)

- (a) The Tour de France is a long and difficult road race in which the cyclists ride for many hours a day. They are in danger of overheating and are constantly provided with water along the route.

Explain why it is necessary for water replenishment during a cycling race such as the Tour de France and describe the **two** homeostatic mechanisms that lead to the cyclists drinking the water. (13 marks)

- (b) A female with a defective kidney received a new kidney transplanted from a non-related male. The female patient failed to take the appropriate medication and the transplant was rejected. Describe the cell-mediated immune response that resulted in the rejection of the transplanted kidney. (7 marks)

End of questions

ACKNOWLEDGEMENTS

Section One

- Questions 5–6** Diagram adapted from: Weiss, M.L., & Mann, A.E. (1985). *Human biology and behavior: An anthropological perspective* (4th ed.). Boston, MA: Little, Brown, p. 31.
- Questions 9–10** Diagram adapted from: Weiss, M.L., & Mann, A.E. (1985). *Human biology and behavior: An anthropological perspective* (4th ed.). Boston, MA: Little, Brown, p. 153.
- Questions 14–15** Diagrams adapted from. Victorian Curriculum and Assessment – Authority. (2000). *Biology written examination: Victorian Certificate of Education 2000* (Section 2, Question 8). © Pearson Education, Inc., publishing as Benjamin Cummings.
- Questions 20–21** Diagram adapted from: Traub, S. (Ed.). (1996). *Basic skills in interpreting laboratory data: Illustrated with case studies* (2nd ed.). [Bethesda, MD]: American Society of Health System Pharmacists. Retrieved March, 2013, from www1.shore.net/~straub/labsk_nephron.htm
- Question 24** Diagram adapted from: *Growing new heart valves*. Berlin: German Heart Institute Berlin, Figure 1. Retrieved February, 2013, from www.dhzb.de/science/
- Question 30** Image adapted from: *Background*. (n.d.). Bethesda, MD: National Institute of Drug Abuse. Retrieved March, 2013, from <http://mybrainnotes.com/brain-cortex-neurons.html>

Section Two

- Question 32(a)–(b)** Adapted from: Endocrine system [Diagram]. In American Medical Association. (n.d.). *Atlas of the human body*. Retrieved February, 2012, from www.ama-assn.org/ama/pub/physician-resources/patient-education-materials/atlas-of-human-body/endocrine-system.page
- Question 32(c)–(e)** Adapted from: Purves, W.K., Orians, G.H., & Heller, H.C. (1995). *Life: The science of biology* (4th ed.). Sunderland, MA: Sinauer Associates, & Salt Lake City, UT: W.H. Freeman. Retrieved March, 2013, from www.cartage.org.lb/en/themes/sciences/lifescience/generalbiologie/physiology/endocrinesystem/MechanismsHormone/MechanismsHoMecha.htm
- Question 33** Graph adapted from: *Biology: Tasmanian Certificate of Education 2011*. (2011). Battery Point: Tasmanian Qualifications Authority, p. 10.

- Question 35(a)** Diagram adapted from: LadyofHats [Villarreal, M.R.]. (2007, January 5). *Human skull side sutura.*. Retrieved March, 2013, from http://commons.wikimedia.org/wiki/File:Human_skull_side_suturas.svg
- Question 38(c)** Image adapted from: Luong, L.D. (2009, July 2). *Basic principles of genetics* (Lecture 17). Retrieved March, 2013, from <http://cnx.org/content/m26565/1.1/> Licensed under a Creative Commons Attribution 3.0 Unported licence.
- Question 39(a)** Adapted from: Lawson, R. (2007, December 26). *Spinal nervous pathway* [Diagram]. Retrieved January, 2012, from http://wikieducator.org/Nervous_System_Worksheet Used under a Creative Commons Attribution-Share Alike 3.0 Unported Licence.

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