



Government of Western Australia
School Curriculum and Standards Authority



Western Australian Certificate of Education Examination, 2015

Question/Answer Booklet

HUMAN BIOLOGICAL SCIENCE

Stage 3

↑

Place one of your candidate identification labels in this box.

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

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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

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 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.

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Ref: 15-057



HBS3

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 2015*. 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.

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.

- 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.

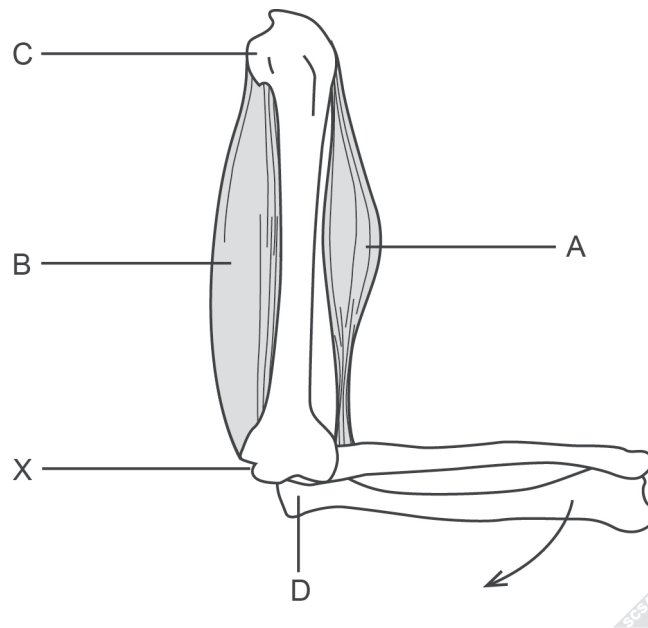
Section One: Multiple-choice

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.

Questions 1 and 2 refer to the diagram below, which shows the bones and muscles of the arm.



- The point shown on the diagram as X where muscle is attached to bone is called the
 - origin.
 - agonist.
 - insertion.
 - fixator.
- Muscle B changes when bone D moves downwards as shown by the arrow in the diagram.

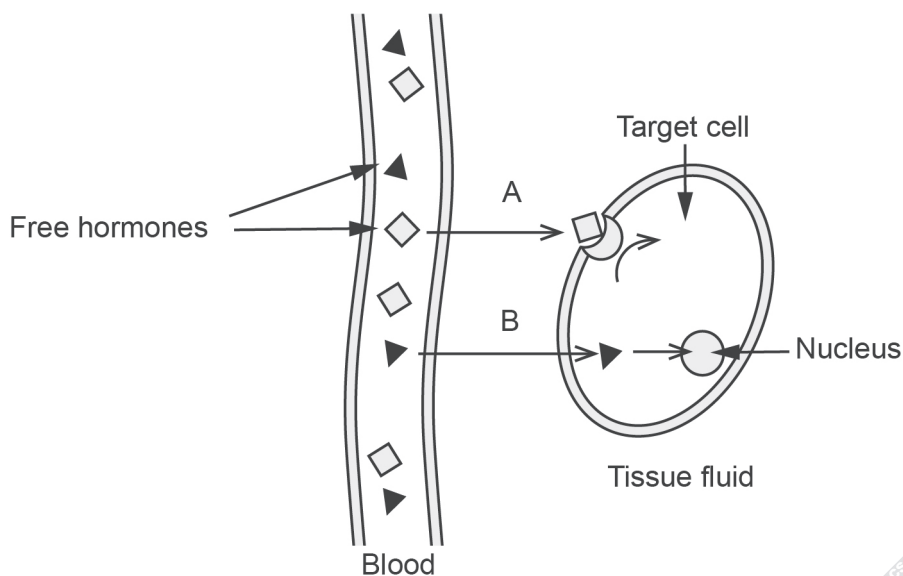
Which row in the following table identifies correctly what is occurring in this situation?

	Change in muscle	Type of movement
(a)	contraction	extension
(b)	contraction	flexion
(c)	relaxation	flexion
(d)	relaxation	extension

See next page

3. Which of the following is the **best** example of the founder effect in action?
- (a) The last green-eyed individual in a small village community died of old age. The village population then only had blue- and brown-eyed individuals, who then reproduced only blue- and brown-eyed offspring.
 - (b) A cyclone destroyed a coastal community, killing many of the members of the local population. Over many generations the population size of the community increased to its original number, with similar genetic characteristics.
 - (c) Housing prices in an isolated country town decreased and many new families moved into the community. The new families came from a variety of different places and possessed a wider range of characteristics than those already in the town, thus greatly increasing the genetic diversity.
 - (d) Because of religious beliefs, a small group of individuals moved away from their community to live together in a new, isolated commune. Over time, the genetic characteristics of the new commune became different from those of the original larger community.

Questions 4 and 5 refer to the diagram below, which shows the mode of action of two different hormones.

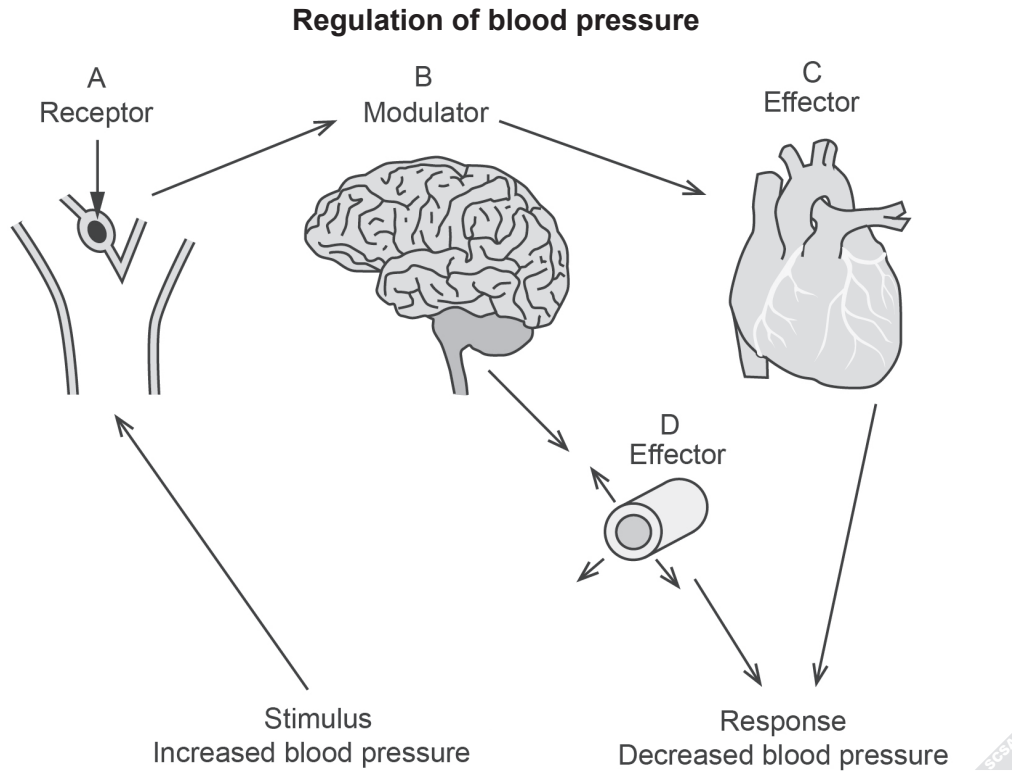


4. A characteristic of hormones A and B illustrated by the diagram is that they
- (a) are secreted by endocrine glands.
 - (b) travel in the bloodstream.
 - (c) can pass easily through a plasma membrane.
 - (d) can bind to many types of cells.
5. Which of the following links correctly the type of hormone with its mode of action as shown by pathway A in the diagram above?

	Type of hormone	Mode of action
(a)	amine	activates a secondary messenger
(b)	amine	activates a gene directly
(c)	steroid	activates a secondary messenger
(d)	steroid	activates a gene directly

See next page

Questions 6, 7 and 8 refer to the diagram shown below.



6. Which of the following identifies correctly the structures involved at A and B?

	A	B
(a)	proprioceptor in blood vessels under the skin	respiratory centre in medulla
(b)	baroreceptor in the carotid artery	cardiovascular centre in medulla
(c)	chemoreceptor in the aorta	vasomotor centre in cerebrum
(d)	thermoreceptor in capillaries in the tissues	hypothalamus and pituitary

7. The response brought about by structures C and D caused a decrease in blood pressure. This decrease was due to

- (a) increased stroke volume and decreased blood flow.
- (b) increased stroke volume and increased breathing rate.
- (c) decreased cardiac output and decreased heart rate.
- (d) decreased cardiac output and increased heart rate.

8. In the reverse feedback loop, where blood pressure is low and needs to be increased, what happens at structure D?

- (a) increased sympathetic stimulation to cause vasoconstriction
- (b) increased parasympathetic stimulation to cause vasoconstriction
- (c) decreased sympathetic stimulation to cause vasodilation
- (d) decreased parasympathetic stimulation to cause vasodilation

See next page

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9. Active, artificial immunity is gained by a
- (a) person receiving a vaccine containing an antigen.
 - (b) foetus in the mother's uterus.
 - (c) baby consuming milk through breast feeding.
 - (d) person suffering a cold and later recovering.
10. Embryonic stem cell therapy can be used to treat diseases of the nervous system.

Below are some of the steps in this process placed in random order.

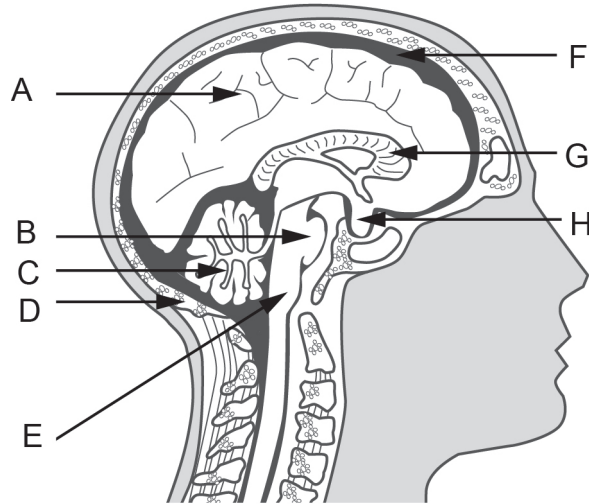
- (i) Nerve cells are injected into the patient.
- (ii) DNA is inserted into a donor egg cell.
- (iii) Cells mature into adult nerve cells.
- (iv) A donor egg is emptied of its contents.
- (v) Damaged nervous tissue is regenerated.
- (vi) Cells are taken from the inner cell mass.

Select the correct order of events in this process.

- (a) (ii), (iv), (vi), (v), (iii), (i)
 - (b) (iv), (ii), (vi), (iii), (i), (v)
 - (c) (iv), (ii), (i), (vi), (v), (iii)
 - (d) (ii), (iv), (vi), (iii), (v), (i)
11. The function of the enzyme DNA ligase is to
- (a) remove a circular DNA strand called a plasmid from a bacterial cell.
 - (b) insert the combined DNA and plasmid into a vector to enable it to be cloned.
 - (c) cut a segment of DNA at a recognition site to isolate it from the rest of the DNA strand.
 - (d) join sticky ends of a segment of DNA and a plasmid together to form recombinant DNA.
12. The role of calcium ions during muscle contraction is to
- (a) prevent myosin heads from forming a cross bridge by binding to the actin molecules.
 - (b) bind to troponin, causing the myosin binding sites on the actin filament to become exposed.
 - (c) cause a change in the shape of the myosin cross bridges, resulting in a power stroke.
 - (d) attach to the myosin molecules, releasing them from the binding sites and repriming them.
13. A person suffering from an underactive thyroid gland would have which of the following symptoms?
- (a) low TSH levels
 - (b) unexplained weight loss
 - (c) high metabolic rate
 - (d) decreased blood pressure

See next page

Questions 14, 15 and 16 refer to the diagram shown below.



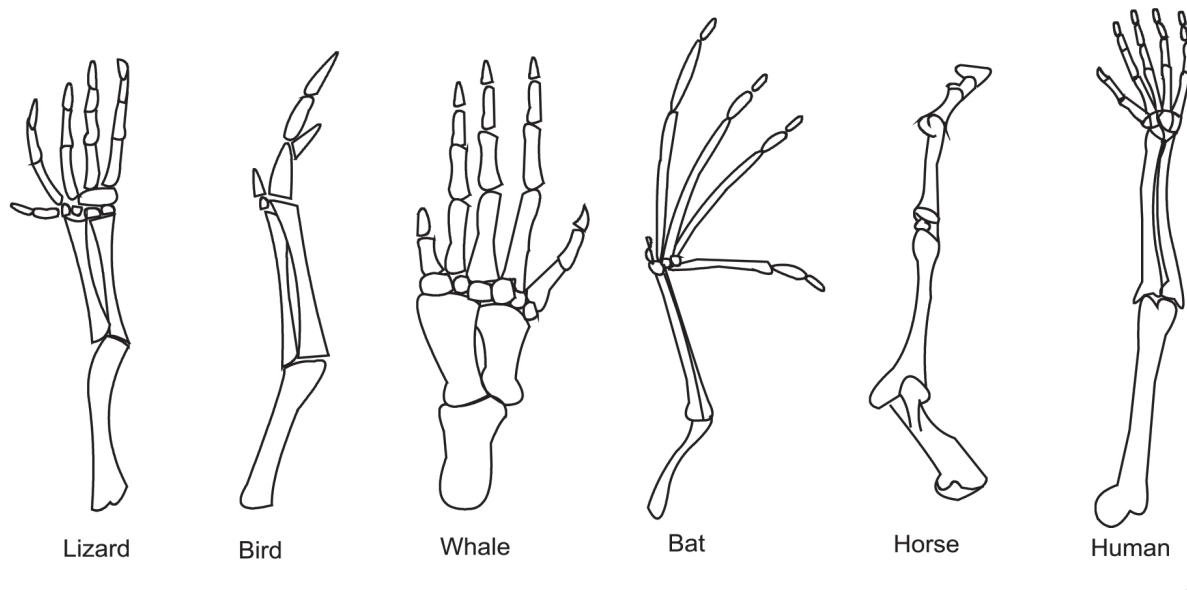
14. The part of the brain responsible for the maintenance of posture and balance is
- H.
 - G.
 - C.
 - A.
15. Two of the structures labelled on the diagram provide protection for the brain. They are
- D and F.
 - D and B.
 - H and F.
 - H and B.
16. An MRI scan of a person's brain revealed they had a tumour growing on the structure shown as E. This tumour was causing dysfunction of structure E. Which of the following would be a possible symptom the person would be experiencing?
- loss of some short- and long-term memory
 - changes to appetite and thirst
 - constant, unexplained sneezing
 - difficulty in walking and jumping
17. Advocates for euthanasia believe that
- health professionals should encourage elderly people to make a decision.
 - no-one has the right to take their own or anyone else's life.
 - only the patient has the right to decide their fate.
 - medical advances might provide cures to terminal illnesses in the future.

18. Which statement concerning fibrocartilage is correct?

Fibrocartilage is made up of

- (a) coarse bundles of collagen fibres.
- (b) web-like elastic fibres.
- (c) invisible fine collagen fibres.
- (d) branching collagen fibres.

Questions 19 and 20 refer to the diagram shown below.



19. The name given to the type of evidence of evolution shown in the diagram is

- (a) comparative embryology.
- (b) homologous structures.
- (c) vestigial organs.
- (d) analogous characteristics.

20. The **best** explanation for the evidence of evolution shown in the diagram is that

- (a) the bird and the bat both use the limb as a wing to fly. The bird and the bat must have the more recent common ancestor than the other vertebrates.
- (b) all the limbs have evolved along different pathways, with the similarity due to coincidence. No relationship is supported by the evidence.
- (c) the highly-specialised limb of the horse makes it the most different from all the others. The horse must be the most distantly related to the other vertebrates.
- (d) all the limbs display a similar structure but function differently. All of these vertebrates must have shared a common ancestor at some point in time.

Questions 21 and 22 refer to the information below.

For a number of years, there has been a belief among some people that the immunisation of infants and children causes autism. Many studies have focused on potential links between the ingredients in vaccines and their possible side effects. Mercury has been one of the ingredients tested. Numerous long-term experiments have been conducted to determine whether there is a link between autism and the presence of mercury in vaccines. However, no link has been established.

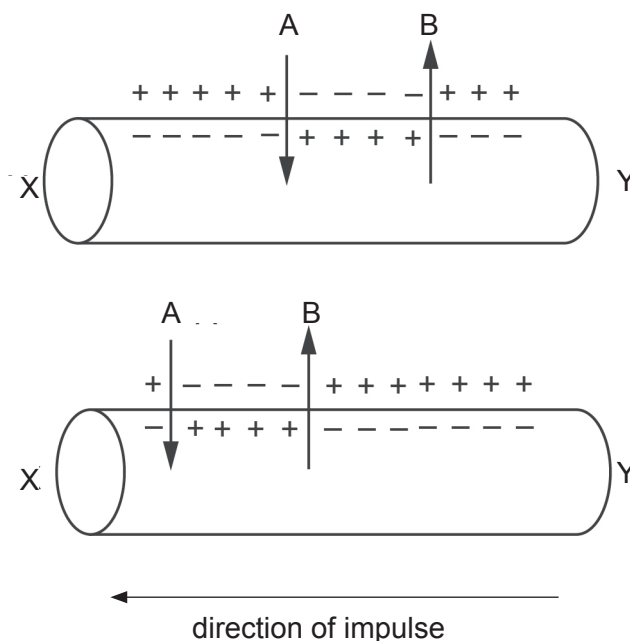
21. Which of the following is a logical hypothesis for such an experiment?
- (a) Autism is caused by mercury.
 - (b) Vaccines without mercury are better for infants and children.
 - (c) Vaccines containing mercury do not cause autism.
 - (d) Do vaccines containing mercury cause autism?
22. The dependent variable in this experiment would be the
- (a) volume of vaccine administered.
 - (b) number of infants and children in the study.
 - (c) amount of mercury in the vaccine.
 - (d) number of new cases of autism.
23. Specific types of genes can influence the production of proteins and therefore the expression of structural genes. Two such genes are called promoter and regulator genes. However, they have different roles in the expression of structural genes.
- Which of the following statements is correct?
- (a) Promoter genes are the sites for the binding of RNA polymerase to DNA.
 - (b) Regulator genes start the transcription of mRNA in structural genes.
 - (c) Regulator genes prevent DNA polymerase from binding to promoter genes.
 - (d) Promoter genes produce repressor proteins that bind to an operator gene.
24. The DNA code for three amino acids, in sequence, is shown below.

CCA TAC AAT

What would be the matching code in transfer RNA?

- (a) CCA TAC AAT
- (b) GGU AUG UUA
- (c) CCA UAC AAU
- (d) TTAATG GGT

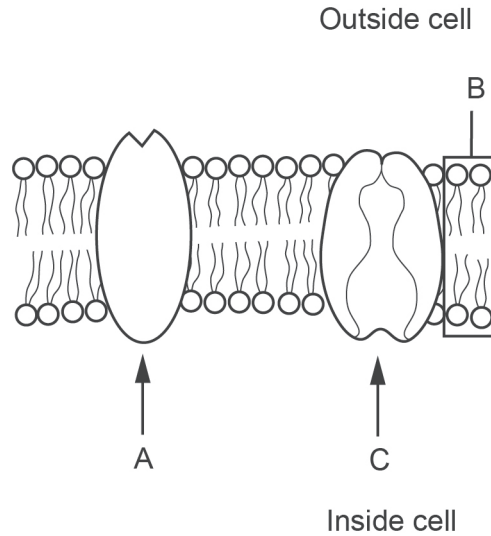
Questions 25 and 26 refer to the diagram shown below, which represents a nerve impulse moving along the axon of a neuron. The flow of ions across the axon membrane is represented by arrows.



25. Which of the following is correct? Arrow
- A represents potassium ions.
 - B represents chloride ions.
 - A represents sodium ions.
 - B represents calcium ions.
26. What is occurring between arrows A and B?
- action potential
 - resting state
 - repolarisation
 - myelination
27. The composition of messenger RNA that is initially produced in the nucleus from a DNA molecule is not exactly the same as the messenger RNA that arrives at the ribosome to carry out protein synthesis.
- Which of the following processes produces this difference?
- Exons are added to the DNA in the cytoplasm before it reaches the ribosome.
 - Introns are removed from the messenger RNA before it leaves the nucleus.
 - Codons are changed when the messenger RNA reaches the ribosome.
 - Anticodons are joined to the messenger RNA when it leaves the nucleus.

See next page

Questions 28, 29 and 30 refer to the diagram shown below.



28. The structure labelled A represents a protein that is able to communicate between cells to stimulate changes in adjacent cells. This is called a
- channel protein.
 - receptor protein.
 - carrier protein.
 - mediator protein.
29. Structure B consists of phospholipids. Lipid-soluble hormones are able to pass through this part of the membrane. This is due to structure B possessing
- hydrophilic lipid heads and hydrophobic phosphate tails.
 - hydrophilic lipid tails and hydrophobic phosphate heads.
 - hydrophobic lipid heads and hydrophilic phosphate tails.
 - hydrophobic lipid tails and hydrophilic phosphate heads.
30. Some substances that move through structure C from the inside to the outside of the cell require energy. Which of the following statements regarding this movement is correct?
- The concentration of the substance would be higher on the inside of the cell than the outside of the cell, so would require energy to move.
 - ATP is required to change the shape of the substance so that structure C can assist it to pass through the membrane.
 - The ATP attaches to structure C and is carried through the membrane to provide energy for removing the substance from the cell.
 - The substance would move against a concentration gradient and would require ATP as its energy source.

End of Section One

See next page

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.

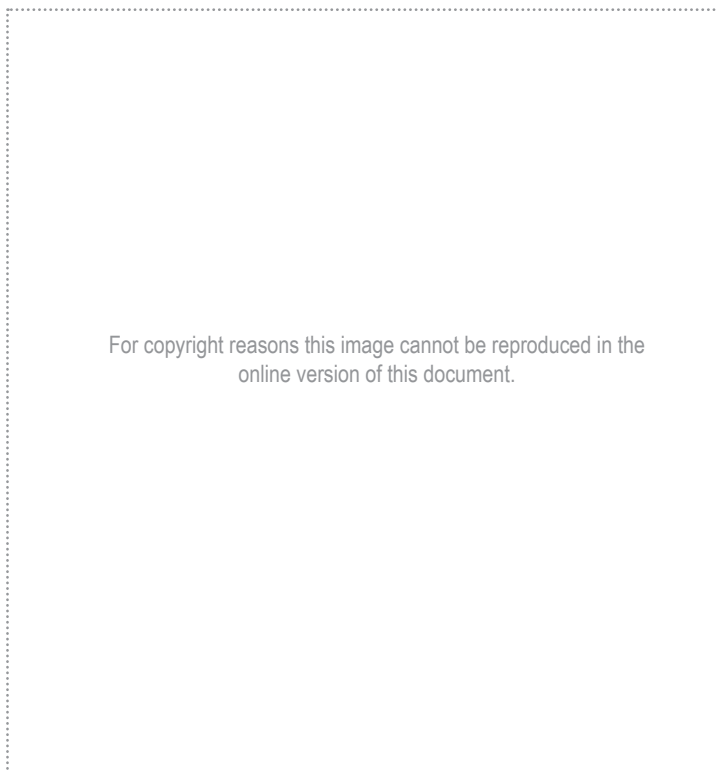
- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question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

Suggested working time: 90 minutes.

Question 31

(14 marks)

Parts (a) and (b) of the question refer to the diagram of a generalised freely movable joint shown below.



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

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

See next page

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

- (b) Osteoporosis and osteoarthritis are medical conditions that can affect structures shown in the joint diagram.

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

Osteoporosis _____

Osteoarthritis _____

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

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

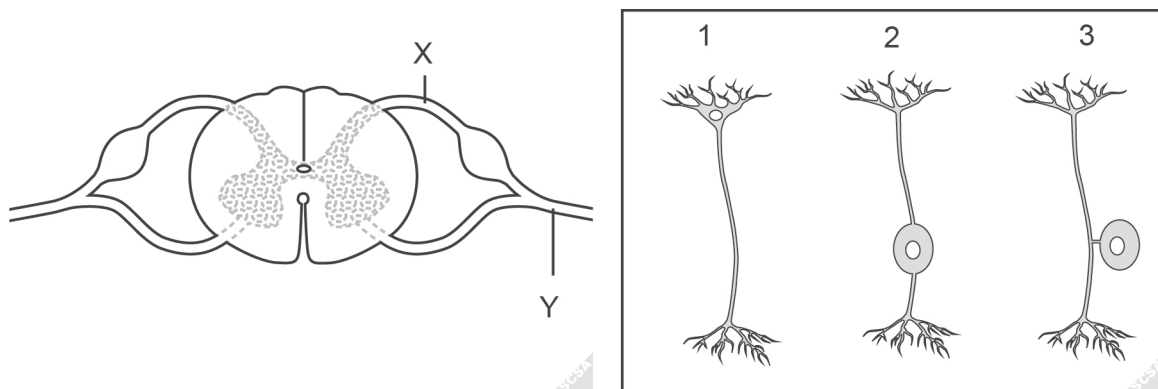
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Question 32

(15 marks)

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

- (b) The diagram below shows a cross-section of the spinal cord and associated structures. Three different neurons are drawn in a box to the right.



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

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

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

See next page

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

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

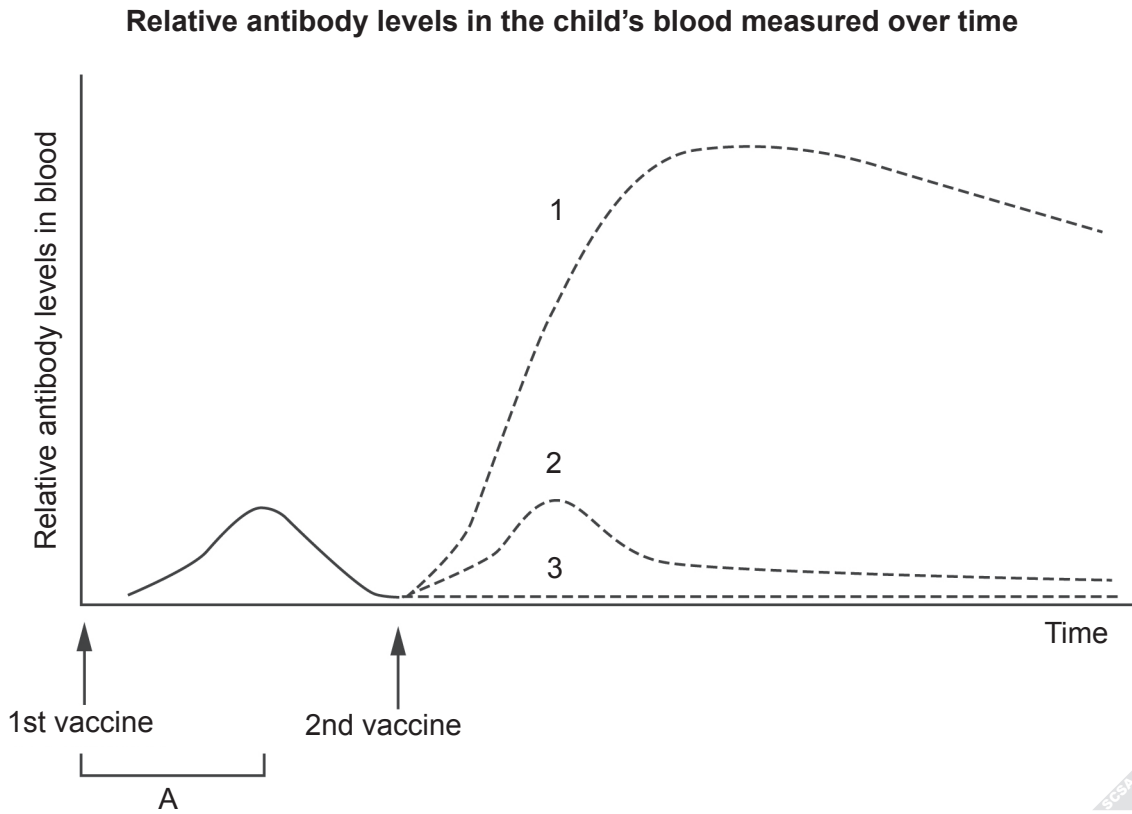
Differences between the divisions of the peripheral nervous system	
Autonomic division	Somatic division

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Question 33

(9 marks)

A young child was given a vaccine containing antigens for a viral disease. Several months later, the child was given the vaccine a second time, in what is known as a booster injection. The antibody levels in the child's blood were measured over this period and are shown in the graph below.



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

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

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

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

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

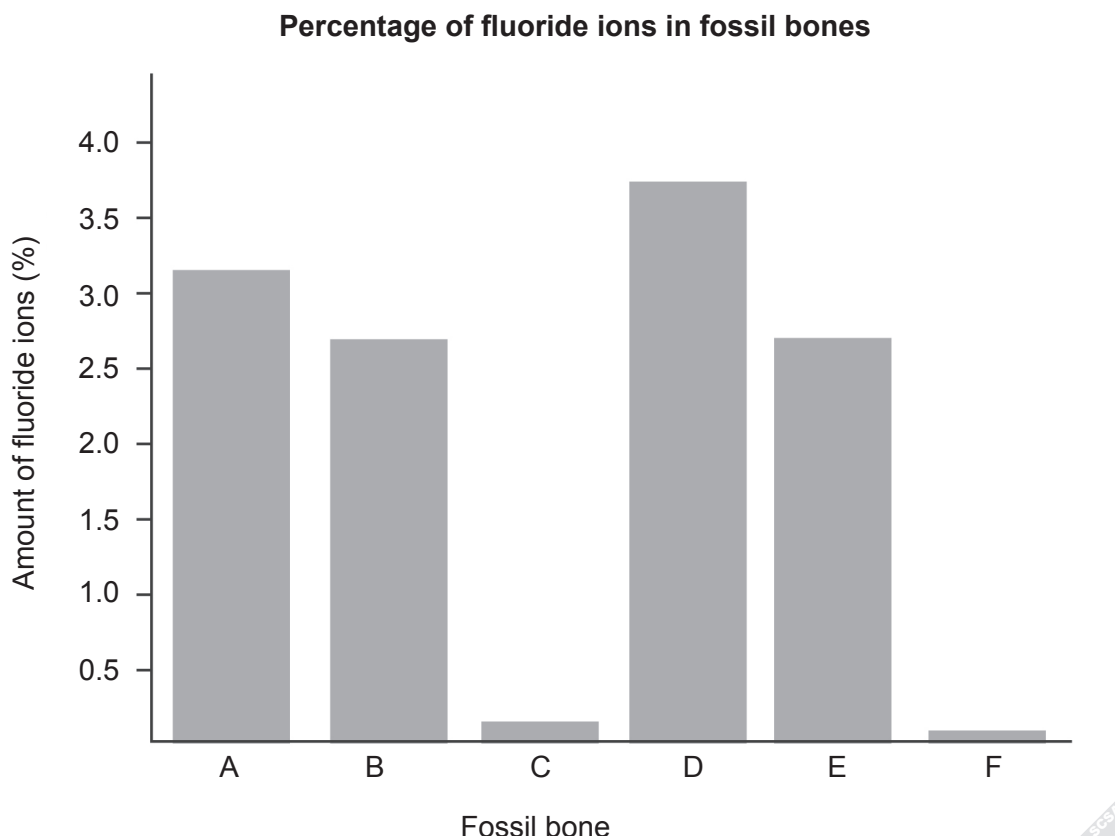
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Question 34

(10 marks)

Fluorine dating can be used to determine the relative age of a fossil by examining the percentage of fluoride ions present in bone.

The graph below shows the percentage of fluoride ions in six different fossil bones found at a single site.



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

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

See next page

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(c) Results from another relative dating method conflicted with the results given by fluorine dating, as they showed fossil bones B and E to be of different ages.

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

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

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

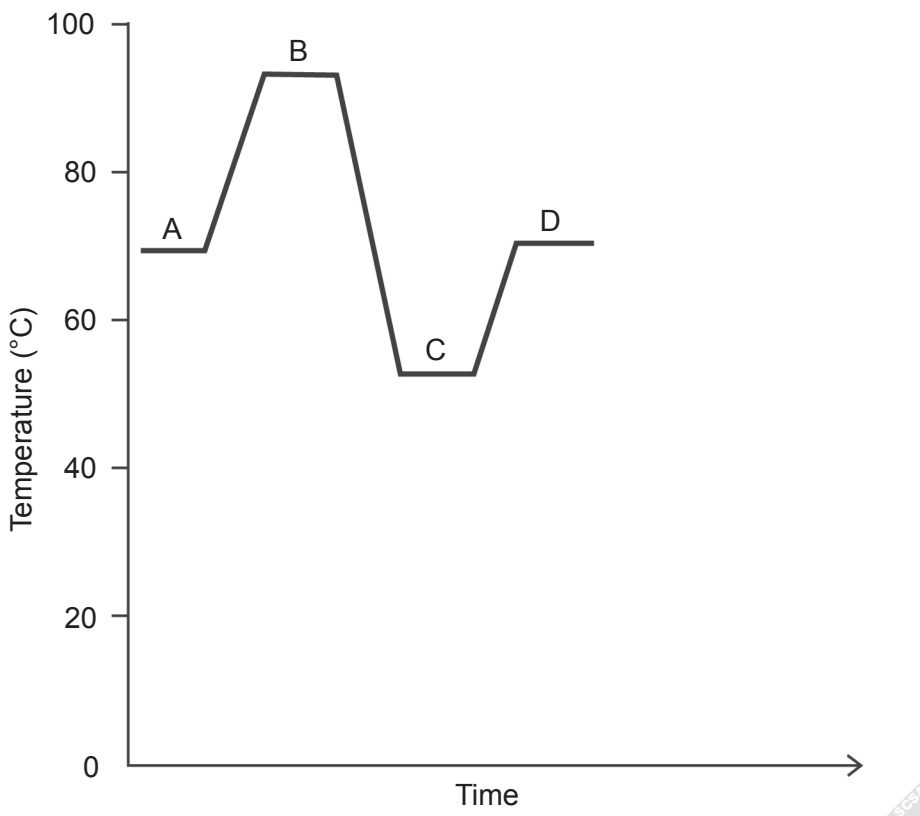
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Question 35

(9 marks)

The graph below indicates the temperatures at which different parts of the polymerase chain reaction (PCR) cycle occur.

Temperature (°C) versus time during PCR cycle



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

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

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

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

(d) PCR can be used to assist in the identification of a crime suspect when there are only very small amounts of DNA available, as it replicates the DNA many times. Once this has been achieved, a profile of the person's DNA can be determined by a technique called 'gel electrophoresis'.

Explain how gel electrophoresis works. (4 marks)

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Question 36

(9 marks)

Apnoea of prematurity is a common condition in premature infants (infants born earlier than 38 weeks gestation). Apnoea results in a complete stoppage in breathing for up to 20 seconds or more. Apnoea has various causes but if left untreated can result in low blood pressure and heart rate, brain damage, and sometimes death. Infants with apnoea of prematurity often require help with their breathing, which may include insertion of a breathing tube (intubation) or being supplied with oxygen-rich air in the humidicrib. One of the most common drug treatments for apnoea of prematurity is daily doses of caffeine, which helps to stimulate the breathing reflex and eliminate the symptoms of apnoea.

Presented below are some of the results from an experiment on the effects of caffeine in premature infants. In group A, 960 infants were administered daily doses of oral caffeine. In group B, 932 infants were administered daily doses of an oral placebo. All infants in the experiment were born between 26 and 28 weeks gestational age. All were given daily doses of either caffeine or the placebo for six weeks.

	Mean age of infants (gestational age) in weeks	
	Group A	Group B
Age at first dose	27.8	28.1
Age at last dose	33.8	34.1
Age at last use of breathing tube (intubation) required	29.5	30.4
Age at last use of additional oxygen required	33.7	35.3

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

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

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

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

See next page

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

Additional data collected during the study indicated that group A infants gained less weight than group B infants.

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

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

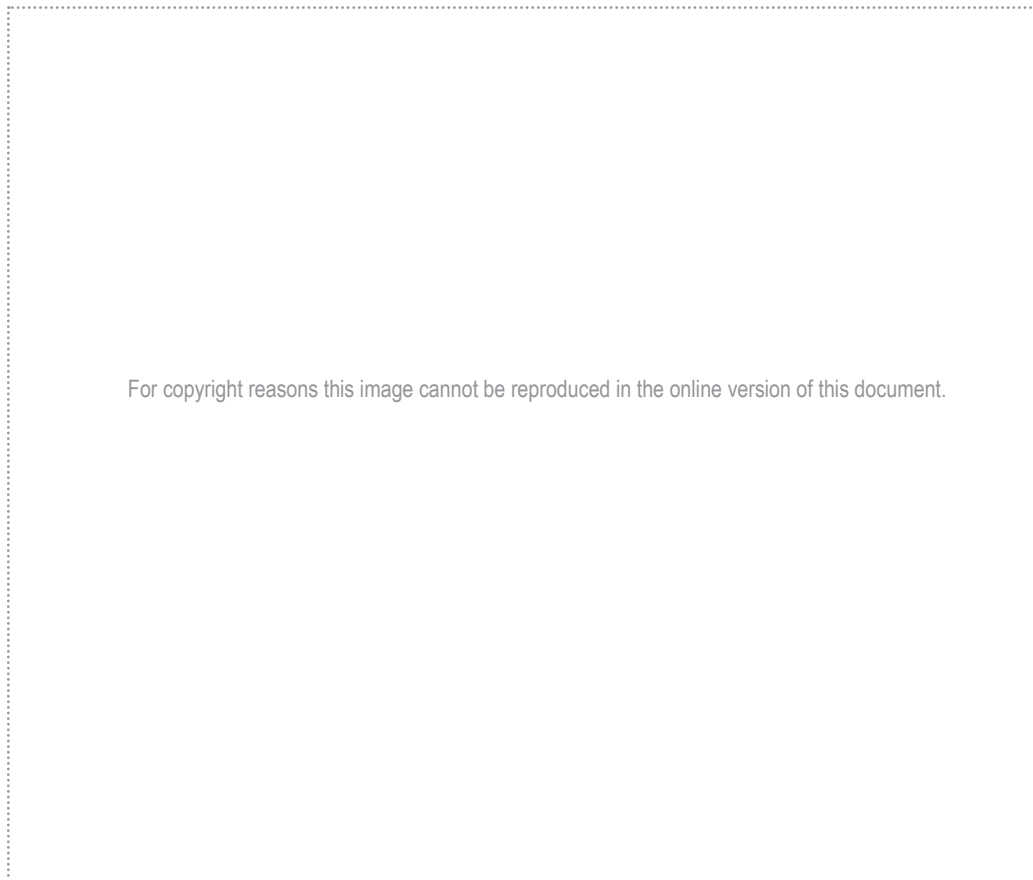
- (ii) Breathing can be altered voluntarily, allowing individuals to increase or decrease breathing rate or even stop breathing for a short time. What part of the brain voluntarily controls breathing? (1 mark)

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

Question 37

(13 marks)

Parts (a), (b) and (c) of the question refer to the diagram of the endocrine system shown below.



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

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

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

See next page

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(c) Structure B is divided into two lobes, called the 'anterior' and 'posterior'. The production and release of hormones from these lobes is different.

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

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

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

Hormonal response compared to a nervous response	
Time taken to respond	
Duration of response	

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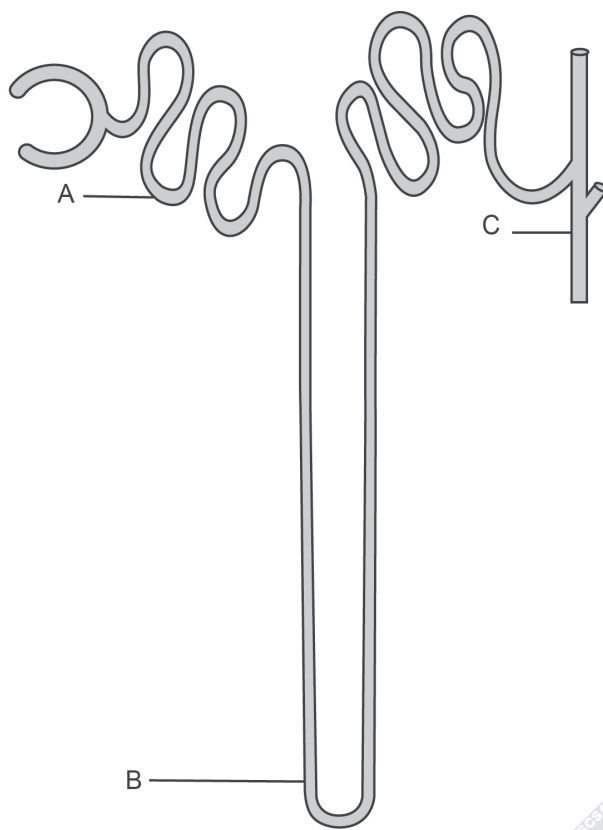
Question 38

(11 marks)

A group of scientists travelled around the world, studying different climates and weather patterns.

During the summer, they were stranded in a desert on a very hot day. Although they did not have any water to drink, they were able to prevent dehydration for a period of time by the involuntary control of water loss from their kidneys.

The following diagram shows three regions in the kidney nephron that would have been involved in preventing their bodies from dehydrating too quickly.



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

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

See next page

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

At region C, antidiuretic hormone controls the amount of water lost in the urine.

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

During winter, the group of scientists visited a mountainous region, where temperatures fell to well below 0°C. Although they had shelter, they were required to frequently work outside in the freezing temperatures.

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

Mechanism	What happens in freezing conditions?	This mechanism is controlled by the hypothalamus and transmitted by	How does this help maintain body temperature?
Blood vessels			Reduces heat loss
Muscles		Somatic nervous system	
Metabolic rate	Increase in metabolic rate		Produces heat

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Question 39

(10 marks)

Archaeologists excavating a site in the Dordogne region of France came across a complete fossilised footprint. Based on its characteristics, they thought it had been made by a species of hominin.

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

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

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

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

(3 marks)

Functional area of cerebral cortex	Advantage
Association	
Motor	
Sensory	

End of Section Two

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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 on 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 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.

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.

Answer any **two (2)** questions from Questions 40 to 42.

Indicate the first question you will answer by ticking the box next to the question. Write your answer on pages 32–36. When you have answered your first question, turn to page 37 and indicate the second question you will answer on that page.

Question 40 **(20 marks)**

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

Identify **three** of these hormones, state the specific location where they are produced and explain how they assist in the maintenance of optimal blood glucose levels. (12 marks)

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

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

See next page

Question 41 (20 marks)

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

- (a) Explain how a change in skin colour could be stimulated by the exposure to UV light. (7 marks)
- (b) Many different theories aim to explain how variation in skin colour exists between human populations. Using your knowledge of natural selection and how environmental factors can affect skin colour, explain how light skin may have first evolved from a population of dark-skinned individuals. (7 marks)
- (c) Explain how epigenetic factors could possibly alter gene expression. (6 marks)

 Question 42 (20 marks)

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

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

- (b) Around 5–6 million years ago, environmental conditions in Africa changed. These changes are believed to have contributed to the appearance of the first hominin individuals. Outline the environmental changes that occurred in Africa, identify the important hominin characteristic that evolved as a result of these changes and explain how this new characteristic was advantageous for hominins in the new environment. (8 marks)

Question number: _____

Series of horizontal lines for writing the answer.

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

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End of questions

ACKNOWLEDGEMENTS

Section One

- Question 14–16** *Diagram of brain* (public domain). (n.d.). Retrieved February, 2015, from www.wpclipart.com/medical/anatomy/brain/brain_diagram_2.png.html
- Question 19–20** Pentadactyl limbs [Diagram] adapted from: Curriculum Council. (2009). *Human Biological Science Stage 3 sample examination, 2010* [Unpublished paper]. Curriculum Council, p. 24.

Section Two

- Question 31(a)–(b)** Pearson Education. (2006). *Moveable joint* [Diagram]. Retrieved February, 2015, from www.kean.edu/~jfasick/docs/Spring_09_AP-1/Chapter%208_Part%201.pdf
- Question 37(a)–(c)** 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 Copyright 1995-2012. American Medical Association. All rights reserved.

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