Government of **Western Australia**
Curriculum Council

WACE
Western Australian Certificate of Education

Western Australian Certificate of Education
Examination, 2010

Question/Answer Booklet

HUMAN BIOLOGICAL SCIENCE

Stage 3

Please place your student identification label in this box

Student Number: In figures | | | | | | | | |

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

To be provided by the candidate
Standard items: pens, pencils, eraser, correction fluid/tape, ruler, highlighters

Special items: non-programmable calculators satisfying the conditions set by the Curriculum Council for this course

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.

2011/5098
Web version of 2010/31162

Ref: 10-061

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	20	20	30	20	20
Section Two: Short answer	10	10	90	100	50
Section Three: Extended answer	3	2	60	60	30
				Total	100

Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2010.* Sitting this examination implies that you agree to abide by these rules.

2. Answer the questions according to the following instructions.

   Section One: Answer all questions on the separate Multiple-choice Answer Sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, do not erase or use correction fluid, and shade your new answer. 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 answers in this Question/Answer Booklet.

3. 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.

4. 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(s) that you are continuing to answer at the top of the page.

See next page

Section One: Multiple-choice **20% (20 Marks)**

This section has **20** 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; do not erase or use correction fluid, and shade your new answer. 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: 30 minutes.

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1. Receptor proteins

   (a) always bind with molecules inside a cell to cause changes within that cell.
   (b) enable communication between cells to stimulate change in adjacent cells.
   (c) will bind with a range of types of molecules on the surface of a cell.
   (d) bind with only one type of molecule, but with unlimited numbers of that molecule.

2. Which of the following correctly lists the cultural advances of the hominin group in the most likely sequence of development (from earliest to most recent)?

   (a) painting, use of fire, manufacture of simple stone tools, agriculture
   (b) agriculture, painting, use of fire, manufacture of simple stone tools
   (c) manufacture of simple stone tools, use of fire, painting, agriculture
   (d) use of fire, painting, agriculture, manufacture of simple stone tools

Question 3 refers to the x-ray image shown below.

3. The joint shown in the x-ray is an example of a/an

   (a) ball and socket joint.
   (b) gliding joint.
   (c) immovable joint.
   (d) hinge joint.

See next page

4. Which of the following statements relating to the Human Genome Project is true?

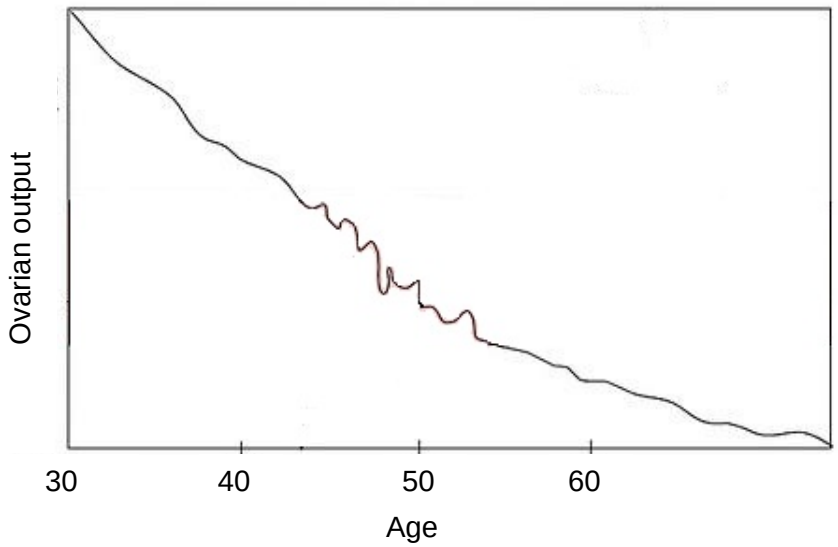
   (a) The DNA sequencing is yet to be completed.
   (b) Information from the project relates only to modern humans.
   (c) It can provide cures for all human diseases.
   (d) It can provide new avenues for advances in medicine.

5. If you were conducting research into the role of epigenetics, which of the following pairs of individuals would be the most useful to study?

   (a) a mother and her son who both have a defective gene for hearing
   (b) identical twins who both have the blood clotting disorder haemophilia
   (c) a father who is colour blind and his son who has normal vision
   (d) a female who carries the gene for breast cancer and her fraternal twin sister who does not carry the gene

Question 6 refers to the graph shown below.

Changes to Ovarian Output with Ageing

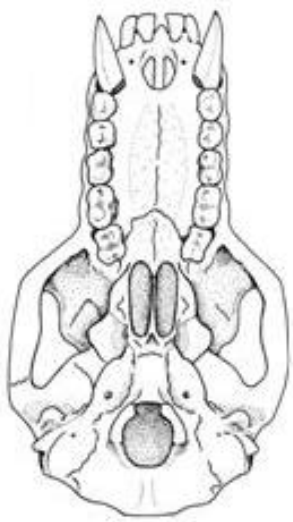
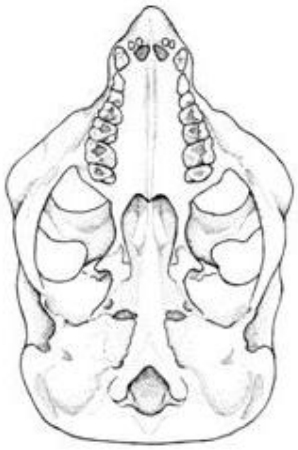
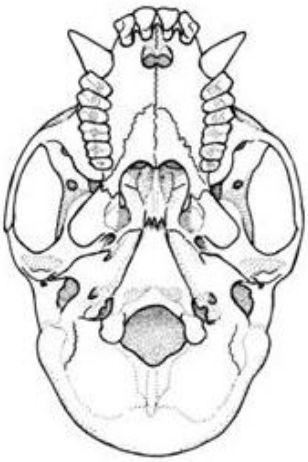


6. The changes seen in ovarian output with ageing are due to

   (a) poor functioning of the pituitary gland, resulting in decreased secretion of follicle stimulating hormone and luteinising hormone.
   (b) a lack of follicles in the ovary, resulting in a decrease of oestrogen and progesterone production.
   (c) decreased production of follicle stimulating hormone, causing decreased oestrogen production.
   (d) decreased production of gonadotropin-releasing factor, causing increased production of luteinising hormone.

See next page

Question 7 refers to the diagrams below that show three different primate skulls.

1	2	3
		

7. Which of the following correctly sequences the primate skulls from the one with the most primitive dentition to the one with the dentition most like that of humans?

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

8. Which of the following is correct?

	Active immunity	**Passive immunity**
(a)	introduces antigens into the body	stimulates formation of antigens
(b)	stimulates formation of antibodies	introduces antibodies into the body
(c)	is induced by vaccination only	is induced by exposure to the environment
(d)	lasts for short periods of time	lasts for long periods of time

See next page

Questions 9 and 10 refer to the information shown below.

The table below shows the number of nucleotide differences between a section of mitochondrial DNA in modern humans, chimpanzees and a Neanderthal fossil.

	Neanderthal	**Chimpanzee 2**	**Chimpanzee 1**	**Human 2**
Human 1	21	76	77	14
Human 2	27	79	80	-
Chimpanzee 1	72	22	-	-
Chimpanzee 2	70	-	-	-
Neanderthal	-	-	-	-

9. Based on the data in the table, which individual is related most closely to the Neanderthal?

   (a) Human 1
   (b) Human 2
   (c) Chimpanzee 1
   (d) Chimpanzee 2

10. The Neanderthal DNA was extracted from a fossil that was approximately 25 000 years old. A method used to determine the absolute age of this fossil could be

    (a) potassium-argon dating.
    (b) stratigraphy.
    (c) fluorine dating.
    (d) carbon-14 dating.

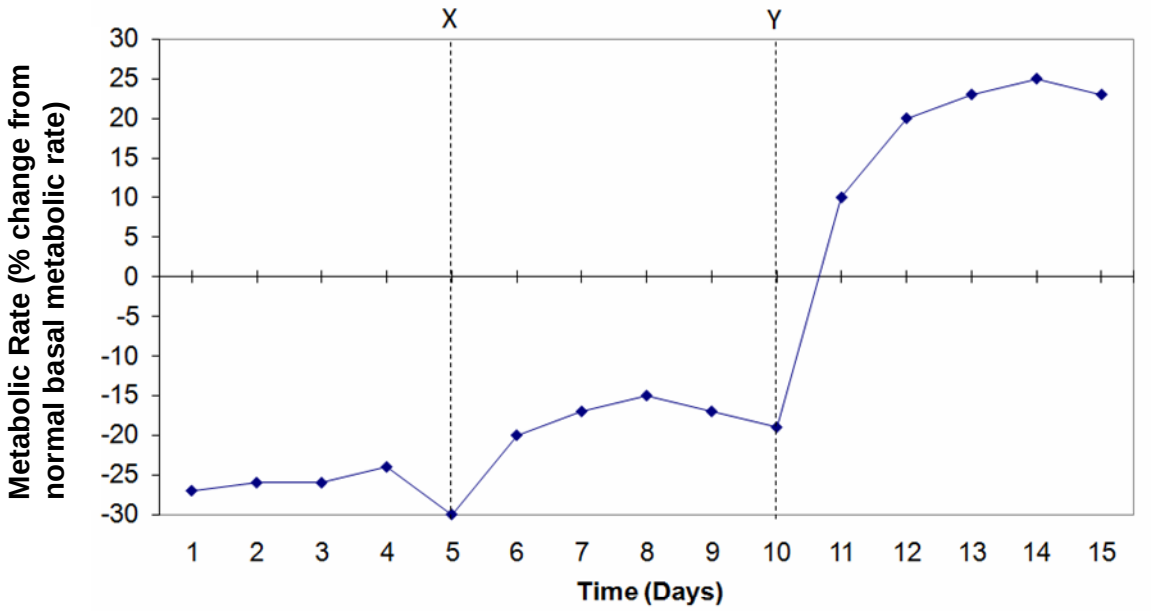
11. The nervous and endocrine systems are both important in the coordination of body functions. However, there are several differences in their modes of action.

    Which one of the following statements concerning these differences is correct?

    (a) Hormones take milliseconds to reach their target, whereas nerve impulses take longer, ranging from seconds to hours.
    (b) Once they have reached their target, hormonal responses last for longer periods of time than nervous responses.
    (c) Hormonal responses involve electrochemical changes, whereas nervous responses involve only chemical changes.
    (d) Nervous responses are usually more general and widespread than hormonal responses.

See next page

Questions 12 and 13 refer to the graph shown below.



The graph above shows the BMR (basal metabolic rate) of a person with a malfunction of a particular endocrine gland. At point X, the patient was given treatment to correct the problem. At point Y, another treatment was given.

Normal BMR is indicated by the horizontal line at zero (0)

12. The malfunction could be due to

(a) a lack of secretion of thyroxine by the thyroid gland.
(b) an over-secretion of glucagon by the Islets of Langerhans.
(c) a lack of secretion of calcitonin from the parathyroid glands.
(d) an over-secretion of thyroid stimulating hormone by the anterior pituitary gland.

13. Symptoms displayed by the patient on day 14 would be

(a) slow heart rate, lack of energy, intolerance to cold, weight loss.
(b) rapid heart rate, weight loss, intolerance to heat, increased appetite.
(c) rapid heart rate, sweating, weight gain, intolerance to heat.
(d) slow heart rate, weight loss, sweating, increased appetite.

See next page

14. Experiments were carried out on three groups of laboratory animals to determine the changes in blood calcium levels over a 24-hour period after the administration of hormones. At the beginning of the experiment, Group A was given calcitonin and Group B was given an equivalent amount of parathyroid hormone. Group C was the control group. Blood samples were taken over the next 24 hours and the blood calcium levels were determined.

The table below shows the average blood calcium levels for the three groups.

Time (hours)	**Blood Calcium Level (mg/100mL of blood)**		
	Group A (calcitonin)	*Group B (parathyroid hormone)*	*Group C (control)*
0	12	12	12
2	8	17	12
4	7	14	12
8	4	12	12
12	3	12	12
24	1	12	12

A logical interpretation of the data would be that

(a) parathyroid hormone decreases blood calcium levels.
(b) calcitonin has no effect on blood calcium levels.
(c) calcitonin has a longer-lasting effect than parathyroid hormone.
(d) parathyroid hormone and calcitonin would be given to Group C.

15. A mutation that involves the deletion of a section of specific base pairs of the DNA, known as CCR5-Delta32, is believed to provide a resistance to HIV infection. Individuals with the homozygous condition for the mutation have almost complete resistance to HIV and individuals who are heterozygous for the mutation have a partial resistance to HIV, where the disease progression is slowed.

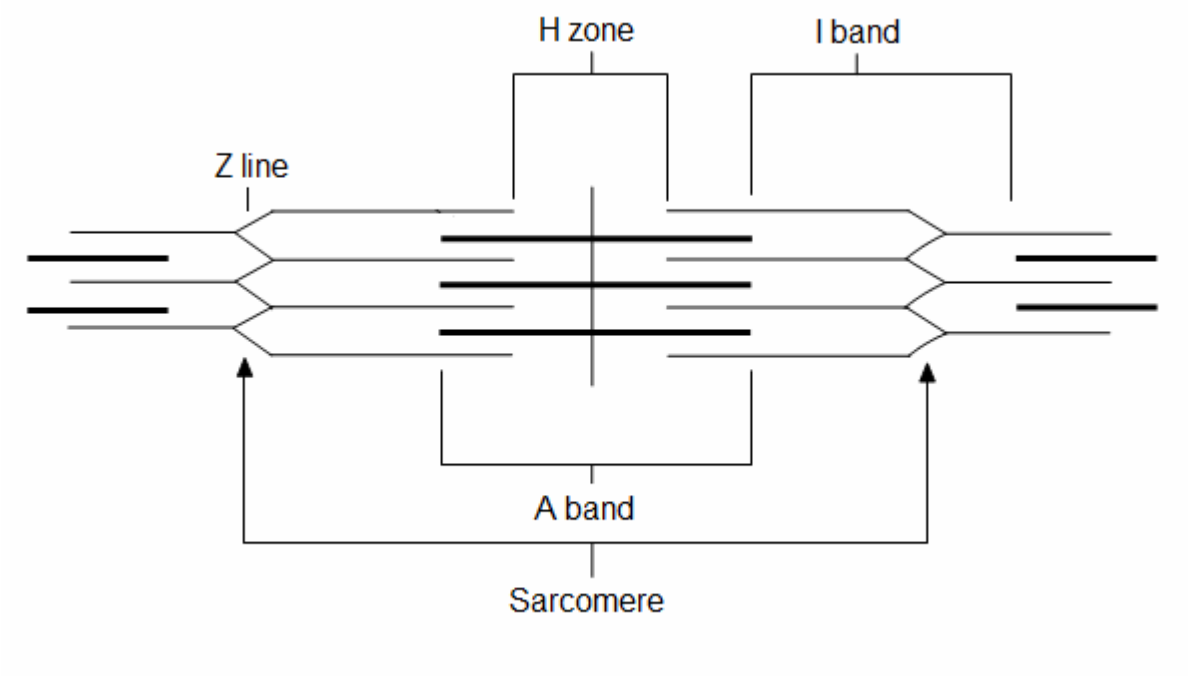
This trait has a frequency of 10% in European populations but has not been found in African, Asian, Middle Eastern or American Indian populations. One theory for the geographical distribution of the mutation is that it also provided resistance to the bubonic plague. Given that European populations were most affected by the plague, the mutation has been inherited in these groups and not others.

The pattern of occurrence of the CCR5-Delta32 mutation can be best attributed to

(a) random genetic drift.
(b) the founder effect.
(c) natural selection.
(d) a geographical barrier to gene flow.

See next page

Question 16 refers to the diagram below, which shows the sliding filament model of muscle contraction.



16. The diagram above predicts that during muscle shortening

(a) Z lines move further apart, A bands shorten and I bands lengthen.
(b) Z lines are drawn closer together, A bands remain the same and I bands lengthen.
(c) Z lines move further apart, A bands lengthen and I bands shorten.
(d) Z lines are drawn closer together, A bands remain the same and I bands shorten.

17. This question is based on the statements below.

(i) Analysis of particular proteins shows that related species demonstrate a high degree of similarity in their amino acid sequences.
(ii) Homologous structures, such as vertebrate forelimbs, show a high degree of similarity in function.
(iii) Comparative embryology provides evidence for evolution by comparing the early stages of development of embryos of different organisms.
(iv) Vestigial structures appear to have no current function but may have been essential for survival in the past.

Which of the statements above provide evidence to support evolutionary change?

(a) (i), (ii), (iii)
(b) (i), (iii), (iv)
(c) (ii), (iii), (iv)
(d) (i), (ii), (iv)

See next page

18. The autonomic nervous system

(a) regulates the activities of skeletal muscles and glands.
(b) is consciously controlled by the cerebral cortex.
(c) contains neurons that send nerve impulses to and from the brain.
(d) contains two neurons with a synapse in a ganglion.

Question 19 refers to the table shown below.

Amino Acids and tRNA anti-codons

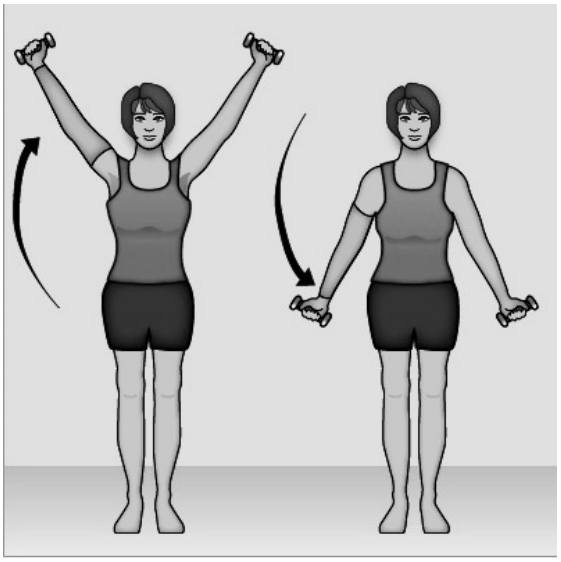
Amino acid	***tRNA anti-codon***
Lysine	AAA
Asparagine	AAU
Threonine	ACU
Isoleucine	AUU
Histidine	CAU
Glutamic acid	GAG
Aspartic acid	GAU
Alanine	GCG
Stop codon	UAG
Tyrosine	UAU
Serine	UCU
Tryptophan	UGG
Leucine	UUA

19. Based on the information about the amino acid formed by the corresponding tRNA anti-codon, which of the following is correct?

	Amino acid	**DNA triplet**	**mRNA codon**
(a)	Histidine	CAT	GUA
(b)	Serine	TGT	AGA
(c)	Glutamic acid	CUC	GUG
(d)	Leucine	TTA	AAT

See next page

Question 20 refers to the diagram shown below.



20. The movement of the arms shown in the diagram is an example of

(a) abduction and adduction controlled by the muscles of the upper arm.
(b) flexion and extension controlled by the muscles of the neck and upper back.
(c) abduction and adduction controlled by the muscles of the shoulder and chest.
(d) flexion and extension controlled by the muscles of the upper and lower arm.

End of Section One

See next page

Section Two: Short answer **50% (100 Marks)**

This section has **ten** 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.

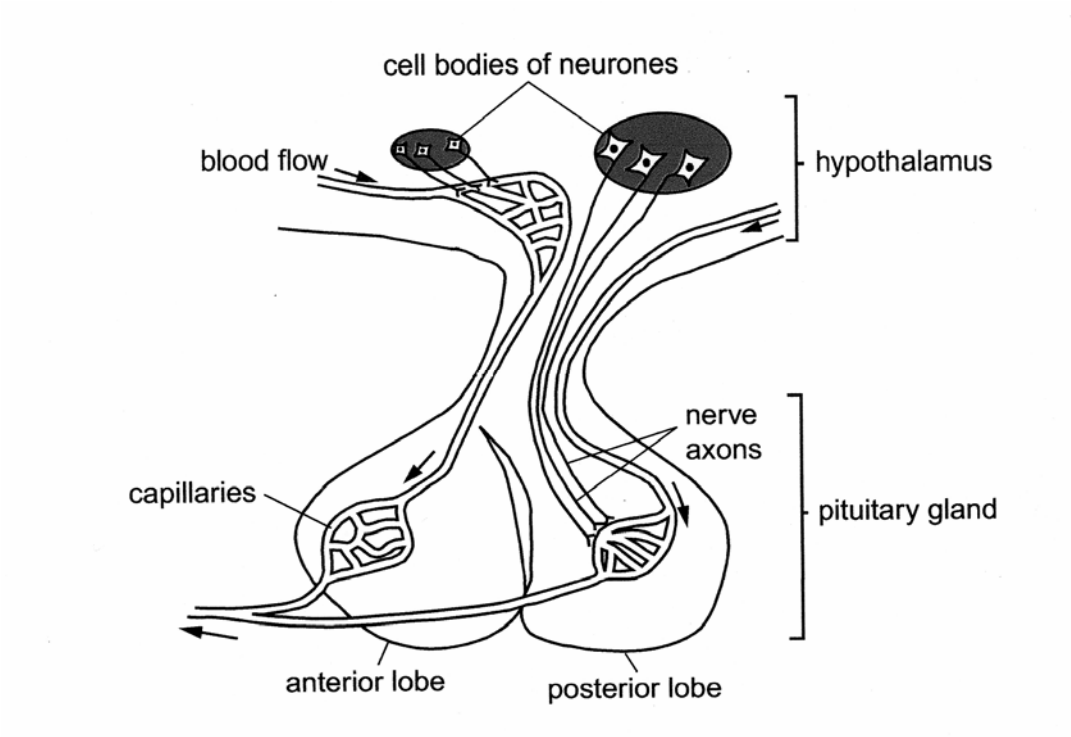
- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s)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

Suggested working time: 90 minutes.

Question 21 **(11 marks)**

Many homeostatic mechanisms are regulated by the hypothalamus.

The diagram below shows the relationship between the hypothalamus and the pituitary gland.



(a) Describe the processes leading to the secretion of hormones from the anterior lobe into the bloodstream. (3 marks)

(b) Explain why the posterior lobe is **not** considered to be a true endocrine gland. (2 marks)

(c) Use the two hormones released by the anterior lobe of the pituitary gland to complete the following table. (4 marks)

Hormone	Target Cells/Organs	Function/s
Adrenocorticotrophic hormone (ACTH)		
Luteinizing hormone (LH)		

(d) The hypothalamus also regulates the production of adrenalin. However, the pathway taken from the hypothalamus to the adrenal gland differs markedly from the pathway taken through the pituitary gland to other target cells. Explain. (1 mark)

(e) Progesterone production is dependent on the hypothalamus. If progesterone levels in the bloodstream are low, the hypothalamus responds. Describe this response. (1 mark)

See next page

Question 22 **(9 marks)**

A biologist is studying animal life in Antarctica, where the average daily temperature is -50^{o}C. His work requires him to be in the open air making observations for long periods of time.

(a) Describe **one (1)** behavioural modification he would need to make, apart from wearing warmer clothing, when outside observing animals. (1 mark)

(b) Physiological mechanisms are also essential for the scientist to maintain his core temperature in these freezing conditions.

Some of these are under nervous control and others are controlled by the endocrine system.

(i) Name **two (2)** mechanisms that his nervous system would control and explain how they would maintain his core temperature. (2 marks)

(ii) What is the modulator for the control of body temperature? (1 mark)

(c) Two other biologists are studying other animal species in completely different conditions to that in Antarctica. One is in a hot desert and the other in a tropical rainforest. Both climates have a similar average daily temperature of 34^{o}C. However, the biologist in the desert feels reasonably comfortable at this temperature, whereas the one in the tropical rainforest finds it very uncomfortable. Explain why. (1 mark)

See next page

(d) After a period of time without nourishment, the blood volume of the biologist in the desert would change more than that of the biologist in the tropical rainforest.

(i) Describe the change that would occur to the biologist in the desert. (1 mark)

(ii) Explain your answer to part (d) (i). (1 mark)

(iii) Explain how this change could affect his blood pressure. (2 marks)

See next page

Question 23 **(12 marks)**

A new drug called Lantus, containing insulin glargine, was approved in 2000 for the treatment of patients who were unable to produce sufficient insulin. Drugs containing NPH insulin had been widely used in the past. Many controlled clinical studies were carried out to enable this approval to be made.

The table below shows the average results produced in some of these trials.

Time after injection (hours)	**Glucose Usage (mg/kg/min)**	
	Lantus	**NPH insulin**
1	0.2	0.4
2	0.5	1.0
4	1.2	3.0
6	1.2	3.4
8	1.0	2.6
10	1.0	1.8
12	1.0	1.2
14	1.0	0.4
16	1.0	0.3
18	1.0	0.2
20	1.0	0.1
22	1.0	0.0
24	1.0	0.0

Note: For insulin to be effective, it needs to be able to maintain glucose usage above 0.4mg/kg/min

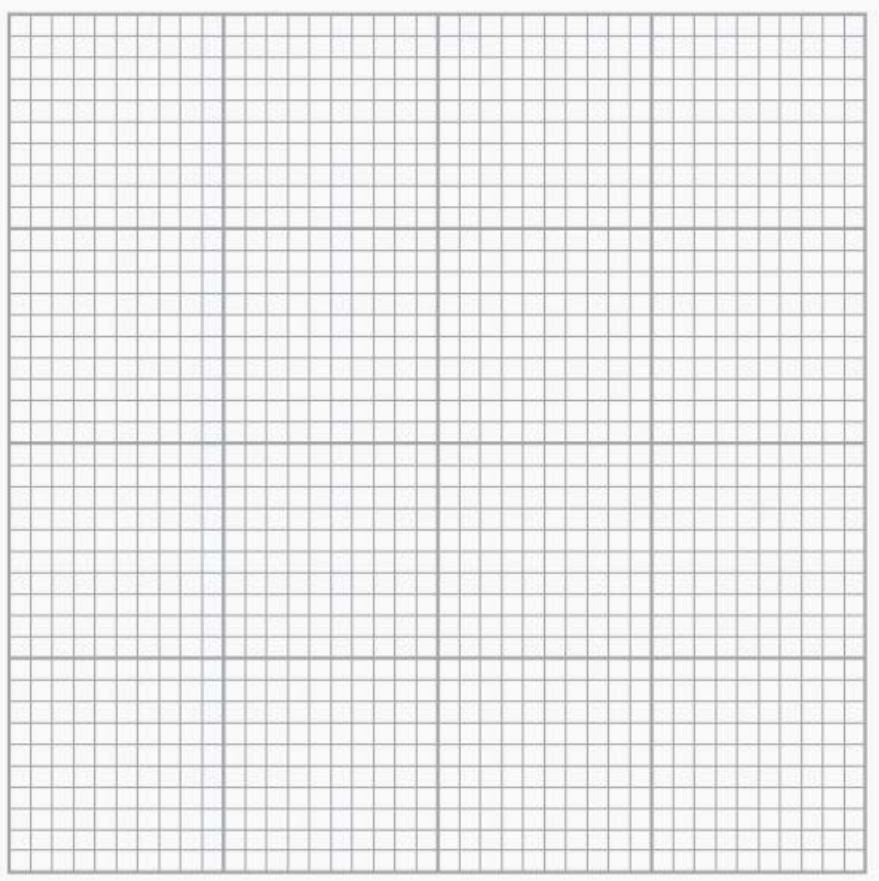
(a) From which disease would these patients be suffering? (1 mark)

(b) Describe how **two (2)** variables would be controlled in this experiment. (2 marks)

See next page

(c) Graph the results from the table on the grid provided below. (5 marks)

If you wish to have a second attempt at the graph, the grid is repeated on page 47 at the end of this Question/Answer Booklet. Indicate clearly on this page if you have used the second grid and cancel the working on the grid on this page.



(d) Using the data from the graph, explain why Lantus would have an advantage over traditional NPH insulin. (2 marks)

(e) Describe **two (2)** processes involved in 'glucose usage'. (2 marks)

Question 24 **(9 marks)**

(a) List, in order of impulse transmission, the neurons involved in a spinal reflex arc. (1 mark)

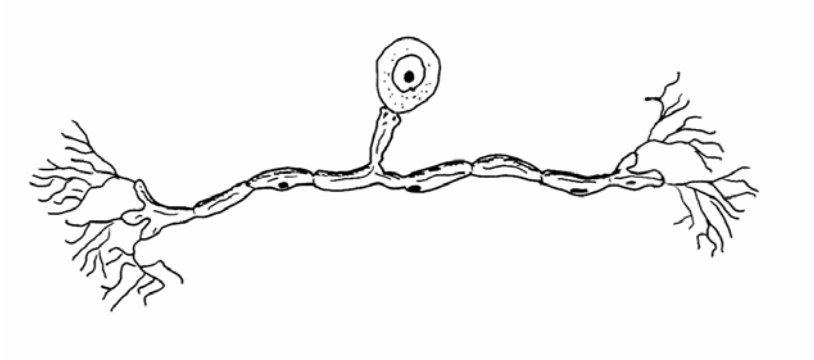
(b) Explain why conscious thought would be a disadvantage in a reflex behaviour. (2 marks)

(c) In a reflex arc, as in all nerve pathways, an impulse travels in only one direction. Explain why. (2 marks)

(d) When a nerve impulse reaches the end of an axon, it cannot go any further as it reaches a gap called a synapse. Explain how the impulse can continue on to the next neuron. (2 marks)

See next page

(e) One of the types of neurons involved in the reflex arc is classified as unipolar. The diagram below shows the general structure of a unipolar neuron.



(i) Name the type of neuron that is unipolar. (1 mark)

_____

(ii) Explain why it is classified as unipolar. (1 mark)

_____

_____

See next page

Question 25 **(9 marks)**

The polymerase chain reaction (PCR) is a process that has revolutionised molecular biology.

(a) Describe the **three (3)** steps involved in the PCR process. (3 marks)

One: _____

_____

_____

Two: _____

_____

_____

Three: _____

_____

_____

(b) Name the enzyme that controls the PCR process. (1 mark)

_____

(c) Name one application of the PCR process. (1 mark)

_____

_____

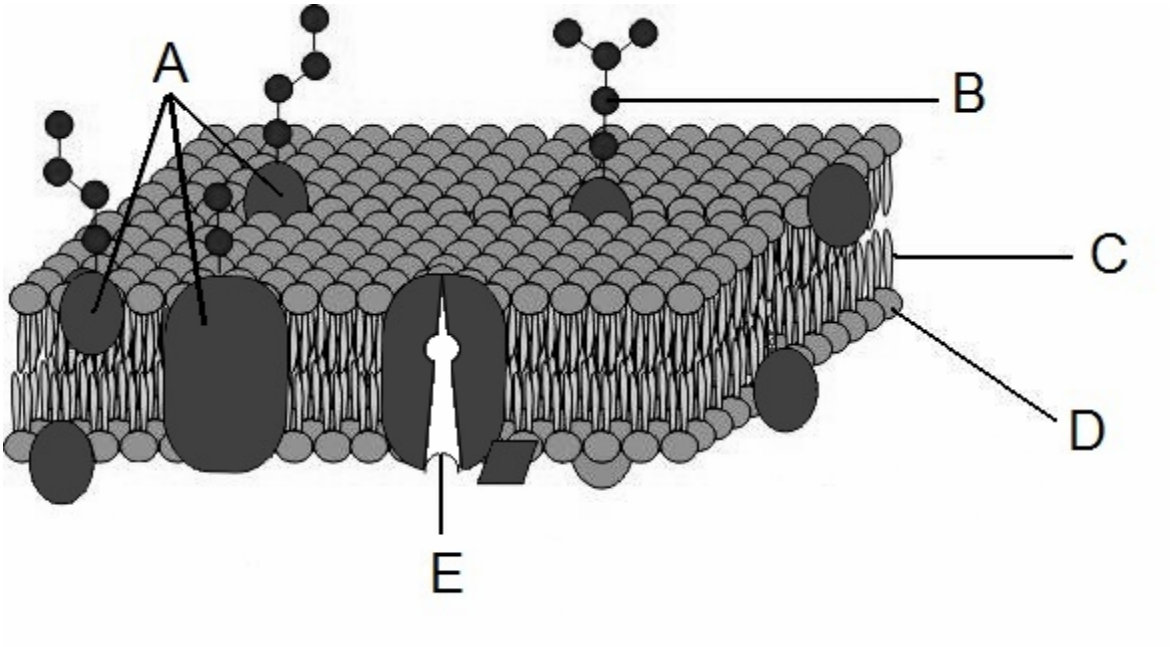
(d) The photograph below shows the equipment used in the process of electrophoresis, which is used widely in molecular biology.

Explain how this process works. (4 marks)

See next page

Question 26 **(10 marks)**

The following parts of question 26 refer to the diagram of the cell membrane shown below.



(a) Structures C and D make up the majority of the cell membrane. Of what types of molecules are these structures composed? (1 mark)

(b) Steroids and fatty acids diffuse easily through the part of the cell membrane made up of C and D, while water must take a different path through the membrane. Explain why. (2 marks)

(c) Name structure E and explain how it is essential to active transport. (3 marks)

See next page

(d) Identify the process that creates the molecules labelled A. (1 mark)

(e) Explain how DNA is involved in the process identified in part (d). (3 marks)

Question 27 **(12 marks)**

Martha's Vineyard is an island off the east coast of the United States. It was first settled in the seventeenth century by a group of English immigrants. During the 1700s and 1800s, the island had an extraordinarily large proportion of individuals with genetically-inherited deafness. At this time, the US mainland had a 1 in 6000 deaf population, while Martha's Vineyard had a 1 in 155 deaf population. The reason for this difference was caused by the evolutionary mechanism known as the 'Founder effect'.

In the last century the difference between the proportion of the deaf population in Martha's Vineyard and mainland USA has diminished. Today Martha's Vineyard does not have a significantly large deaf population.

(a) Explain how the Founder effect would have caused the large number of deaf individuals in Martha's Vineyard during the 1700s and 1800s. (4 marks)

(b) Suggest a factor that would have changed in the 1900s to result in the reduced incidence of genetically-inherited deafness in the Martha's Vineyard population. (1 mark)

(c) Identify another example of a specific population with a high incidence of a genetically-inherited disease. State the population and the disease in your answer. (2 marks)

See next page

(d) A mutation is another type of evolutionary mechanism that can affect frequencies of alleles in populations. Explain the difference in consequences between a mutation occurring in a somatic cell and one occurring in a gamete. (1 mark)

(e) If a mutation is advantageous to the survival of an organism, what would you expect to happen over time? (1 mark)

(f) Identify and describe a technique that may one day provide a cure for disadvantageous mutations. Include an example of a mutation that could be treated with the technique you have identified. (3 marks)

See next page

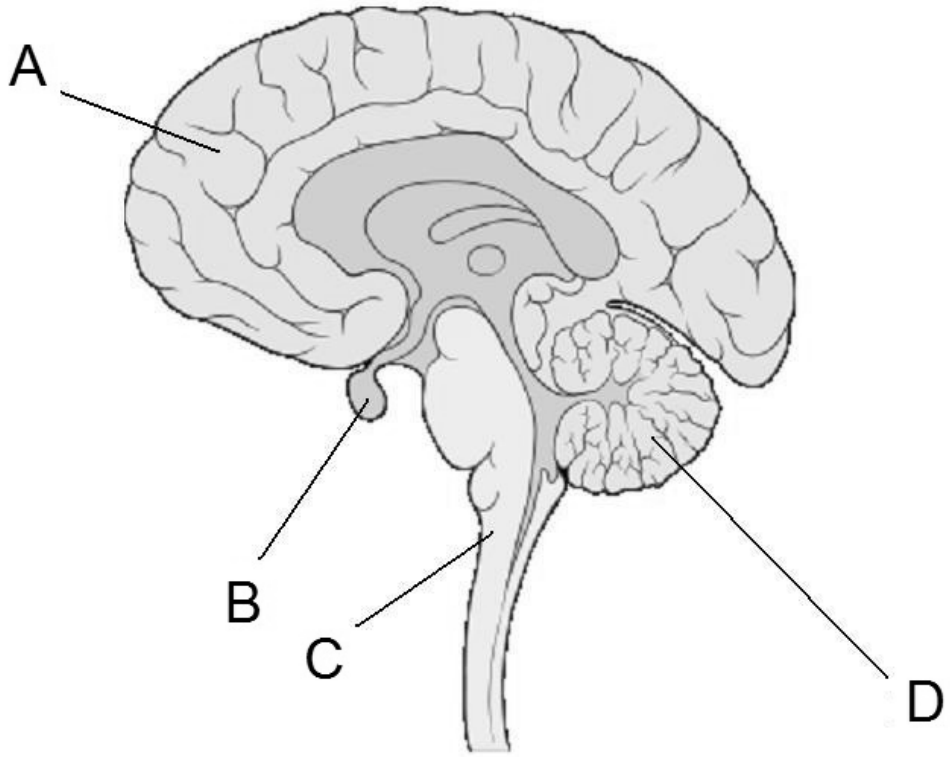
Question 28 **(7 marks)**

Pharmaceuticals are chemical substances, commonly referred to as 'drugs', which are used in the treatment, cure and prevention of disease. Many different drugs can be classed as pharmaceuticals.

(a) Describe the difference between the pharmaceuticals known as antibiotics and antivirals. (1 marks)

(b) Explain why neither antibiotics nor antivirals would be effective in the treatment of Alzheimer's disease. (1 mark)

The following parts of question 28 refer to the diagram of the brain shown below.



(c) Alzheimer's disease is a form of dementia that can cause memory loss, confusion and mood swings. Given these symptoms of Alzheimer's disease, which part of the brain (labelled A-D) above would you expect to be most affected by this disease? (1 mark)

_____

(d) Identify the part of the brain in the diagram opposite (labelled A-D) that maintains balance and posture. (1 mark)

_____

(e) The structure identified in part (d) receives information from many areas of the body to aid in the maintenance of balance and posture. List **three (3)** structures found in the body that provide information to this part of the brain. (3 marks)

One: _____

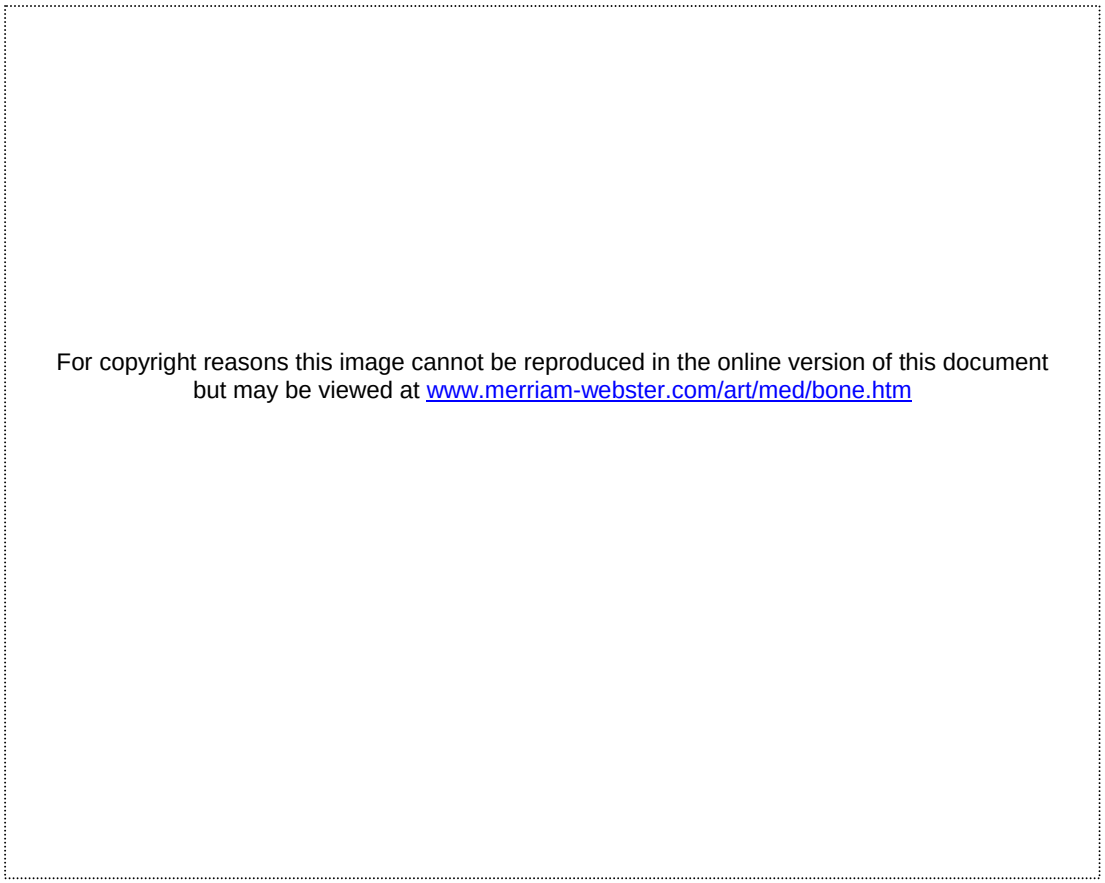
Two: _____

Three: _____

See next page

Question 29 **(11 marks)**

The diagram below represents the macroscopic and microscopic structure of human bone.



(a) Identify the structures labelled A and B. (2 marks)

A: _____

B: _____

(b) State the function of the structures labelled C and D. (2 marks)

C: _____

_____

D: _____

_____

See next page

(c) There are two types of bone marrow in a long bone: red and yellow. How do they differ in function? (2 marks)

(d) Suggest why the density of bone in a long bone needs to differ between the epiphysis and diaphysis. (1 mark)

(e) Osteoporosis and osteoarthritis are both degenerative bone diseases that can be associated with ageing.

Distinguish between osteoporosis and osteoarthritis and state one medical technology that is currently available for the treatment of each of these diseases. (4 marks)

See next page

Question 30 **(10 marks)**

(a) In primates, evolutionary trends can be seen in the level of dependency offspring have on their parents.

(i) Describe this trend. (1 mark)

(ii) Explain how this may increase the survival chances of a primate species. (1 mark)

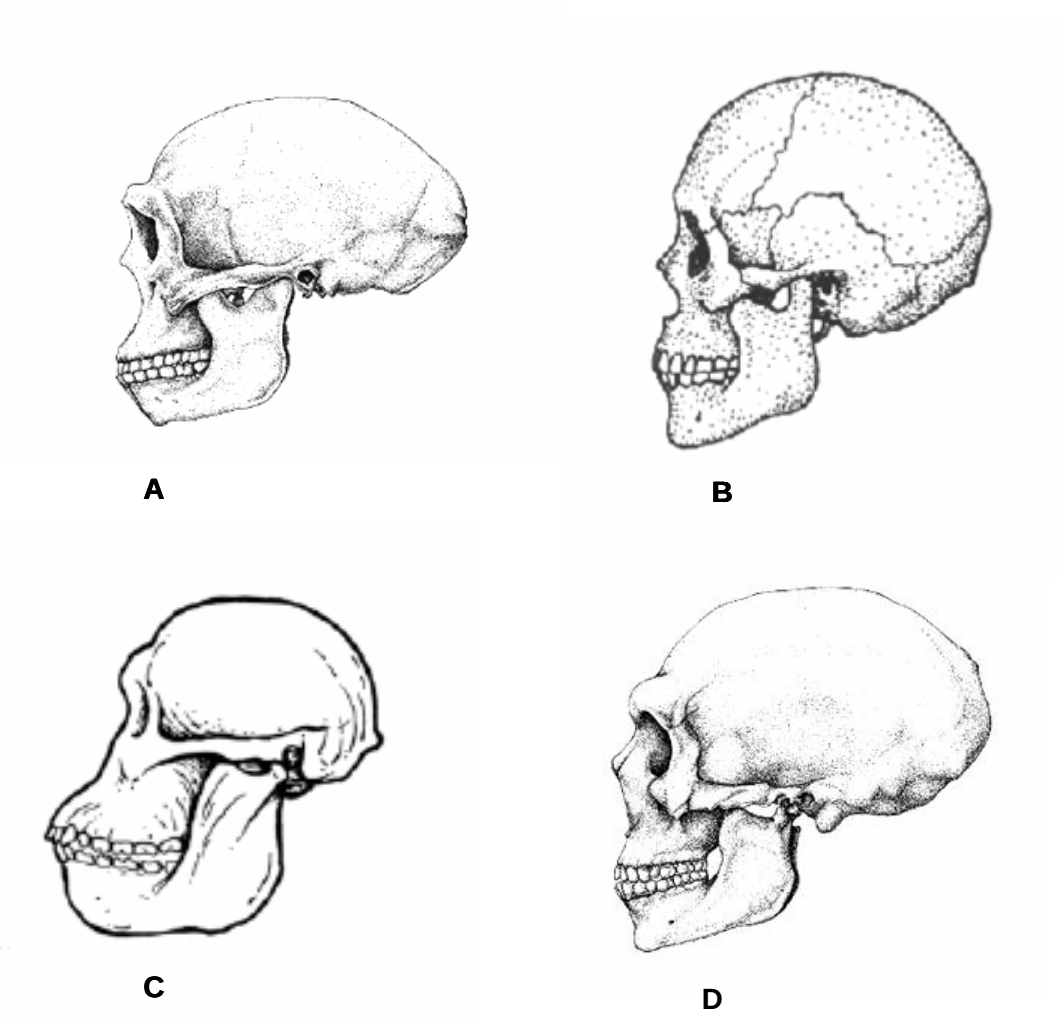
(b) Increased opposability is another trend evident in primate evolution. The human thumb shows the greatest opposability of all primates; however, the big toe has completely lost this function.

(i) What advantage do humans have over other primates, due to their highly-opposable thumb? (1 mark)

(ii) Explain why non-opposability of the big toe is advantageous to humans. (1 mark)

See next page

(c) The skulls below show evolutionary trends in the hominins. These are not placed in the correct evolutionary sequence.



A

B

C

D

(i) Using the letters A-D, place these skulls in the correct evolutionary sequence from most primitive to most recent. (1 mark)

(ii) Identify **three (3)** evolutionary changes evident in the diagrams and suggest why each of these changes may have occurred. (3 marks)

See next page

(d) The change to bipedalism during hominin evolution was advantageous in many ways. One was improved cooling of the body surface. Suggest **two (2)** reasons why bipedalism results in improved cooling of the body surface. (2 marks)

End of Section Two

See next page

Section Three: Extended answer **30% (60 Marks)**

This section contains **three (3)** questions. You must answer **two (2)** questions. Write your answers in the space 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(s) that you are continuing to answer at the top of the page.

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

Suggested working time: 60 minutes.

Question 31 **(30 marks)**

Scientists have been recently analysing a new hominin fossil specimen discovered in Ethiopia named Ardipithecus ramidus and nicknamed 'Ardi'. This specimen is the oldest, most complete, hominin skeleton to be found and is dated at 4.4 million years old. Although it is believed that Ardi would have been a good climber and spent much of her time in the trees, her skeleton shows characteristics that indicate she could employ bipedal locomotion.

(a) Identify the features of the spine, pelvis and leg of a skeleton one might look for to conclude that it was bipedal. Explain the significance of these features to bipedal locomotion. (10 marks)

(b) Ardi is the oldest hominin specimen found to date, but scientists are yet to discover the 'missing link' between other primates and humans. This is one example of a gap in the fossil record, where no significant fossils have been found for a particular species at a particular time.

(i) Outline how the fossil record provides evidence for evolution. (4 marks)

(ii) Examine the reasons why there are gaps in the record. (8 marks)

(c) It is possible that scientists may find more fossil remains at the same site where they found Ardi. If they were to find a bone fragment of another organism but were unable to date it using absolute dating techniques, describe **two (2)** possible relative dating methods they could use instead. Assuming this bone fragment is found in a layer beneath the one Ardi was found in, determine the relative age it could be assigned by each dating technique. Include in your answer a reason why the assigned relative age could be flawed. (8 marks)

See next page

Question 32 **(30 marks)**

(a) If you carry out a high level of physical activity, the osmotic pressure in your cells is increased, stimulating two types of feedback mechanisms that enable your cells to regain optimum water levels.

In the situation described above, explain how homeostasis is maintained by

(i) hormonal control (8 marks)

(ii) conscious action (4 marks)

(b) The nephron of the kidney plays a key role in maintaining homeostasis of body fluid composition by removing the appropriate levels of water from the body.

Describe **two (2)** processes occurring in the nephron that assist with water homeostasis. (6 marks)

(c) Fred is 55 years old and has been told by his doctor that he is suffering from hypertension (high blood pressure).

(i) Suggest reasons why Fred may be suffering from hypertension and describe **two (2)** different types of treatments that the doctor may have discussed with him. (5 marks)

(ii) If Fred follows all of the doctor's advice his blood pressure may be maintained at a normal level. Describe the homeostatic mechanisms under nervous control that would work to maintain Fred's blood pressure within the normal range. (7 marks)

Question 33 **(30 marks)**

(a) John was not immunised against whooping cough when he was an infant. As a teenager he was exposed to the pathogen that caused the disease and became very ill. Jennifer was vaccinated as an infant and when exposed as a teenager she did not contract the disease and showed only very minor symptoms.

(i) Describe the processes that occurred in Jennifer's immune system at the time of vaccination. (15 marks)

(ii) Explain the difference between Jennifer's response and John's response when they were exposed as teenagers to the pathogen. (5 marks)

(b) Describe how vaccines could be produced by recombinant DNA techniques. (10 marks)

End of questions

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

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Question number: _____

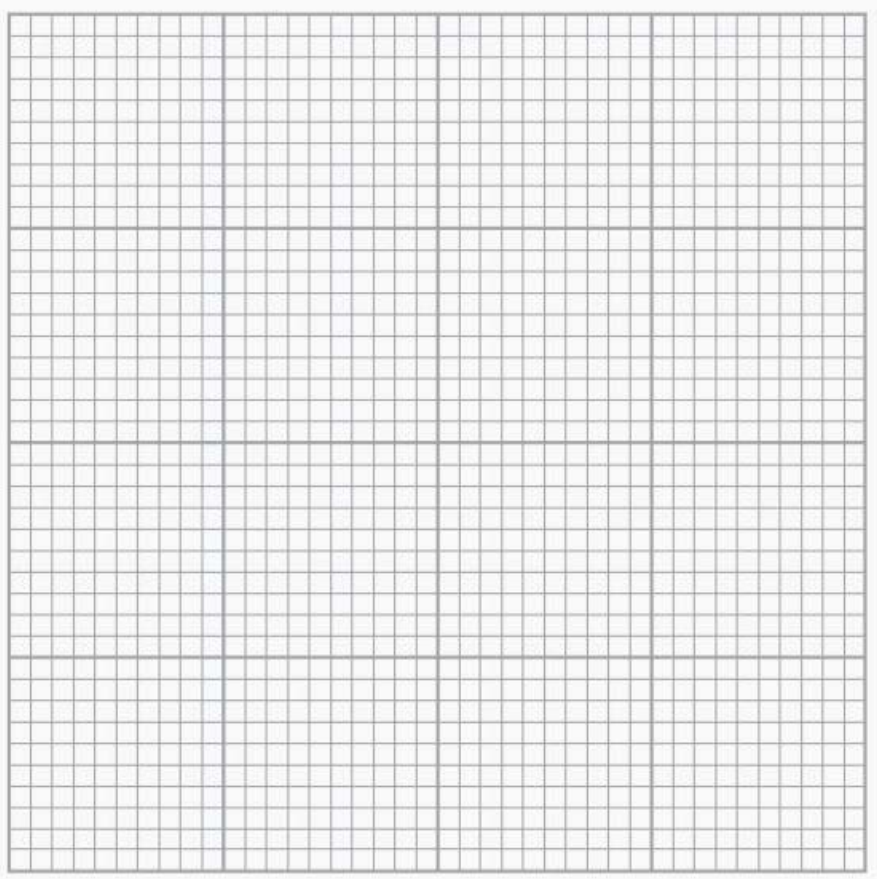
Additional working space

Question number: _____

Additional working space

Question number: _____

Use the grid to answer question 23(c) if you have cancelled your first attempt.



ACKNOWLEDGEMENTS

Section One

Question 3 X-ray image from: Romanes, G., J. (1981). *Cunningham's textbook of Anatomy*. (12th ed.). Oxford University Press. Retrieved February, 2010, from Answers.com website: www.answers.com

Question 6 Diagram adapted from: Surmeno. (2006). *Hormone levels in natural menopause*. Retrieved March, 2010, from Flickr website: www.flickr.com/photos/60755062@N00/215294270/

Question 7 Diagrams of primate skulls from: Lancaster, W., C. (n.d.). *Lab 13-Orders Primates & Scandentia*. Retrieved February, 2010, from California State University website: www.csus.edu/indiv/l/lancasterw/bio168/LABS%20BIO168-03/Lab%2013-Scandentia%20and%20Primates%20BIO168-05.htm

Question 20 Diagram adapted from: Stephan, P. (2009). *How to do arm Lymphedema exercises*. Retrieved February, 2010, from About.com website: http://breastcancer.about.com/od/lifeaftertreatment/ss/arm-lymphedema-exercises_7.htm

Section Two

Question 21 Diagram of cell bodies of neurones from: *Advanced GCE Human Biology Exam 2867 – Genetics Homeostasis and Ageing*. Oxford Cambridge and RSA Examinations. p.12, q. 4.

Question 26 Diagram adapted from: Boumphreyfr. (2009). *Cell membrane3*. Retrieved January, 2010, from Wikimedia Commons website: http://commons.wikimedia.org/wiki/File:Cell_membrane3.png

Question 28 Image adapted from: Lynch, P.J. (2006). Retrieved December, 2009, from Wikimedia Commons website: http://commons.wikimedia.org/wiki/File:Brain_human_sagittal_section.svg

Question 29 Diagram A, B & C adapted from: Merriam-Webster Inc. (n.d.) *Bone*. Retrieved April, 2010, from Merriam-Webster Online website: www.merriam-webster.com/art/med/bone.htm

Diagram D adapted from: Skalar. (n.d.). *Construction of bone*. Retrieved April, 2010, from Kulturystyka.pl website: http://kulturystyka.pl/budowa-kosci-art-by-skalar/.

Question 30(c) Diagrams A and D adapted from: Terrebonne Parish History & Genealogy. (n.d.). Retrieved March, 2010, from: www.terrebonneonline.com

Diagram B from: Foley, J. (n.d.). Retrieved March, 2010, from Talk Origins Archive website: www.talkorigins.org

Diagram C from: Ecotao Enterprises website. (n.d.). Retrieved March, 2010, from: www.ecotao.com

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