



## Western Australian Certificate of Education Examination, 2012

### 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

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### 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 tape/fluid, 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 total exam
Section One: Multiple-choice	30	30	30	30	30
Section Two: Short answer	9	9	90	100	50
Section Three: Extended answer	3	2	60	40	20
<b>Total</b>					100

## Instructions to candidates

- The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2012*. 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 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

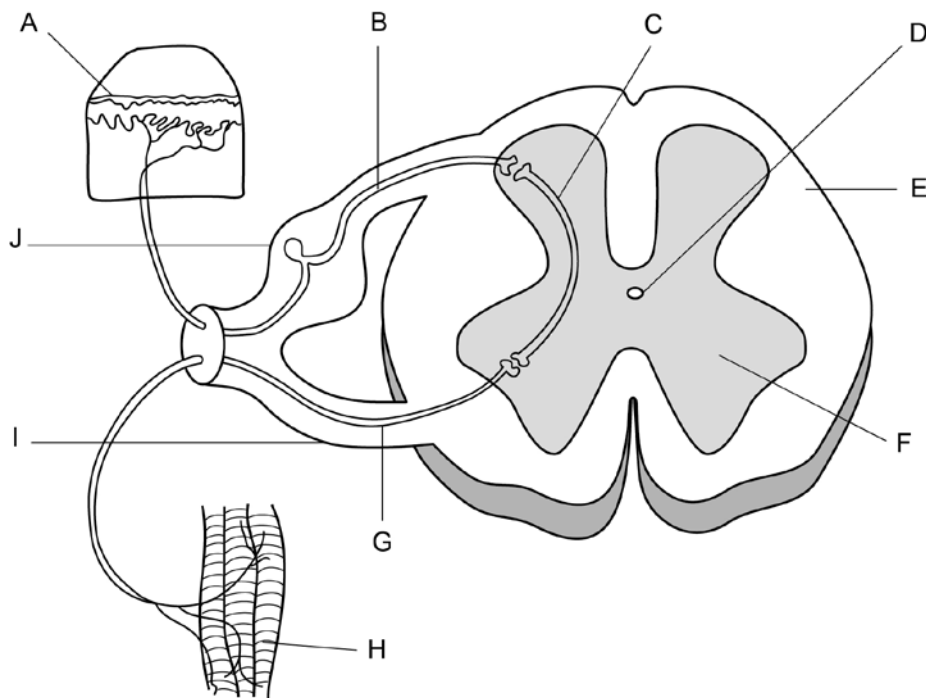
30% (30 Marks)

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: 30 minutes.

Questions 1–3 refer to the spinal reflex arc diagram shown below.



1. Which of the following statements relating to the above diagram of the spinal reflex arc is correct?
  - (a) A stimulus is detected by the receptors labelled 'H' and transmitted through the sensory neuron labelled 'G'.
  - (b) The motor neuron is labelled 'G' and is located in the ventral root labelled 'I'.
  - (c) The interneuron is labelled 'C' and is located in the white matter labelled 'F'.
  - (d) A stimulus is detected by the receptors labelled 'A' and transmitted through the motor neuron labelled 'B'.
  
2. The neuron labelled 'B' in the diagram can be described as an
  - (a) afferent neuron carrying information toward the spinal cord.
  - (b) efferent neuron carrying information away from the spinal cord.
  - (c) efferent neuron carrying information toward the spinal cord.
  - (d) afferent neuron carrying information away from the spinal cord.

See next page

3. A spinal reflex is a
- (a) voluntary, stereotyped response to change.
  - (b) protective, acquired behaviour.
  - (c) rapid, involuntary response to a stimulus.
  - (d) spontaneous response along a complex neural pathway.
4. In the polymerase chain reaction (PCR), DNA and the enzyme DNA polymerase are placed together in a solution that is repeatedly heated and cooled in cycles.

Which of the following is correct?

- (a) Heating provides activation energy for the enzyme DNA polymerase.
  - (b) Cooling denatures the strands of the enzyme DNA polymerase.
  - (c) Cooling binds together the sugar and phosphate within the strands of DNA.
  - (d) Heating breaks the bonds between the bases in the strands of DNA.
5. The order of bases in a section of DNA is TGGACG. The mRNA formed from this would be
- (a) UCCTGC.
  - (b) UGGTCG.
  - (c) ACCUGC.
  - (d) ACCTGC.
6. When the hormone cortisol reaches a target cell, it enters the cell and combines with a receptor protein inside the cell. The combined substance enters the nucleus, where it activates genes to produce a protein.

Cortisol is a

- (a) water soluble amine.
- (b) water soluble steroid.
- (c) lipid soluble amine.
- (d) lipid soluble steroid.

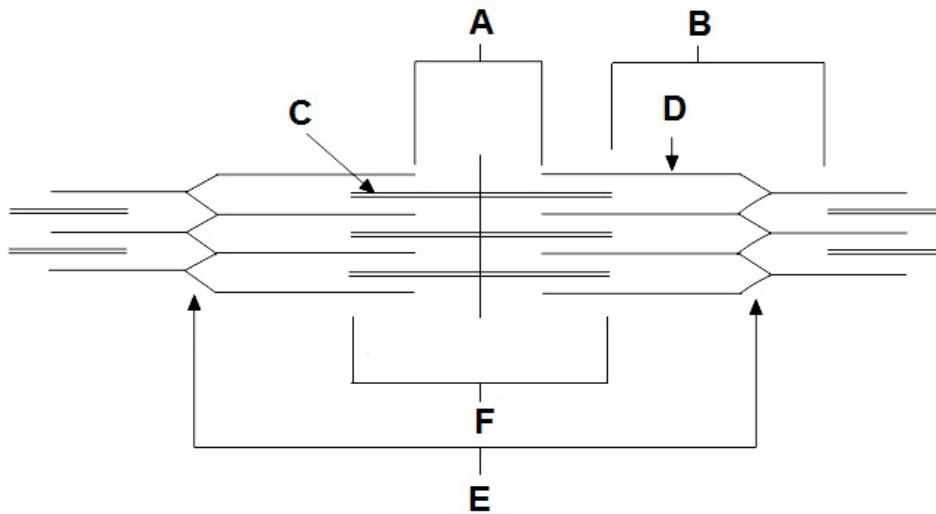
7. Under extreme conditions, humans can suffer from hyperthermia, a condition in which the body temperature rises above its normal level due to the changes in the environmental temperature.

Which of the following factors could contribute to hyperthermia?

- i. low environmental temperatures
- ii. high environmental humidity
- iii. reduced evaporation of sweat from the body surface
- iv. participation in low levels of physical activity
- v. high volume of fluid intake
- vi. increased heat radiation onto the body surface

- (a) i, iii and vi
- (b) ii, iii and vi
- (c) ii, iii and v
- (d) iii, iv and vi

Questions 8–9 refer to the diagram of the functional unit of skeletal muscle shown below.



8. During muscle contraction

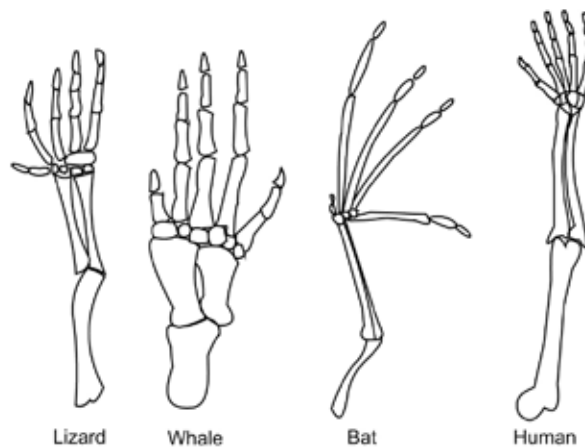
- (a) Structure C decreases in length.
- (b) the distance represented by B shortens.
- (c) the distance represented by A lengthens.
- (d) Structure D increases in length.

9. In the diagram, the proteins actin and myosin are represented by

	Actin	Myosin
(a)	A	C
(b)	F	D
(c)	D	C
(d)	C	D

10. In skeletal muscle contraction, the role of calcium ions is very important. The internal cellular structure that stores calcium is called the
- (a) mitochondrion.
  - (b) motor end plate.
  - (c) microfilament.
  - (d) sarcoplasmic reticulum.
11. Exposure to more UV light results in darker skin colour due to
- (a) an increased number of melanocytes in the skin.
  - (b) an increased amount of melanin in the skin.
  - (c) a decrease in the size of melanosomes in the skin.
  - (d) a decrease in tyrosinase enzyme activity in the skin.

Questions 12–13 refer to the following diagram.



12. The type of comparative study in anatomy shown in these diagrams is
- (a) homologous structures that perform similar functions but show little structural similarity.
  - (b) homologous structures that show a high degree of structural similarity but perform different functions.
  - (c) vestigial structures that perform similar functions but show little structural similarity.
  - (d) vestigial structures that show a high degree of structural similarity but perform different functions.
13. One form of comparative study in biochemistry is the study of proteins. Proteins can be compared to establish how recent is the common ancestry between two species.

Which of the following would show species with more recent common ancestry?

Species with a more similar

- (a) sequence of amino acids in a protein.
- (b) sequence of nucleotides in a protein.
- (c) shape of a protein molecule.
- (d) number of amino acids in a protein.

**See next page**

14. The following is a list of structures in the body that may detect stimuli.

- i. semicircular canals of the inner ear
- ii. stretch receptors in the joints
- iii. retina of the eyes
- iv. baroreceptors in blood vessels
- v. pain receptors in the skin
- vi. pressure receptors in the skin

Which of these structures send information to the brain to assist in the maintenance of balance and posture?

- (a) i, ii, iii and vi
- (b) i, ii, iv and vi
- (c) ii, iv and v
- (d) i, iii, iv and v

Questions 15–16 refer to the lower jaw diagrams shown below.

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15. Which of the following statements about the lower jaws shown in the diagrams is correct?

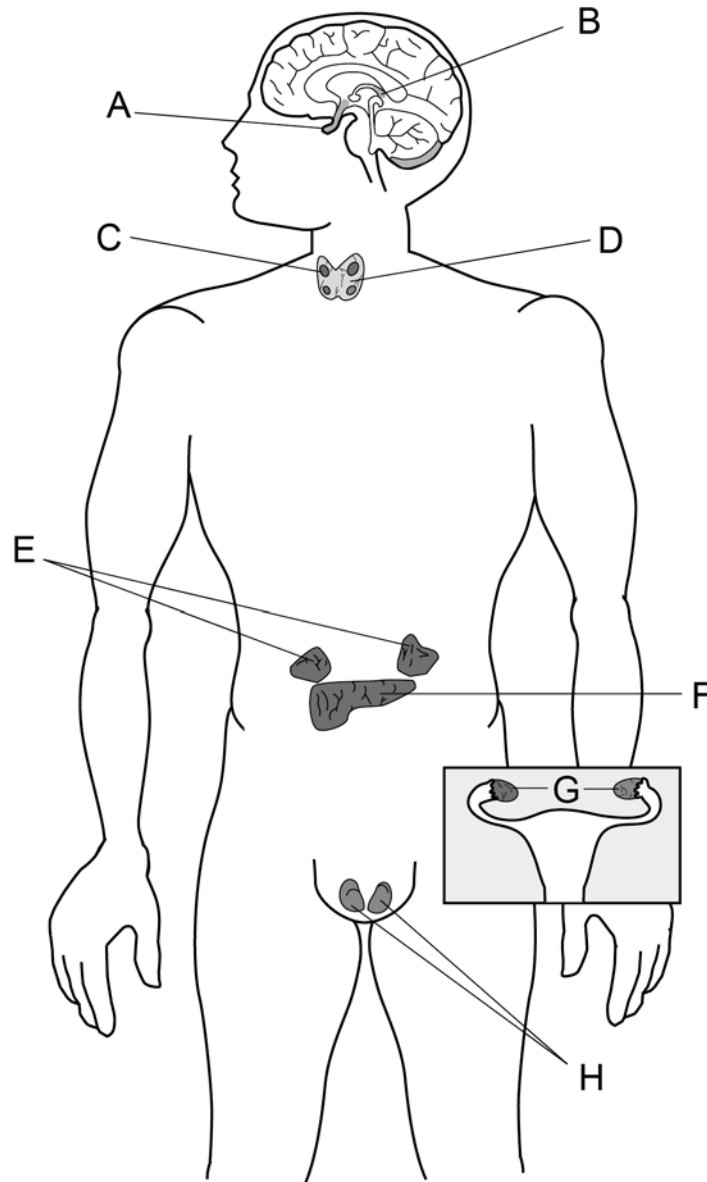
- (a) Jaw P belongs to a modern human because the dental arcade has a parabolic shape.
- (b) Jaw Q belongs to a pongid because the teeth are of an even size.
- (c) Jaw P belongs to a pongid because of the presence of a diastema.
- (d) Jaw Q belongs to a modern human because there are more molars present than in Jaw P.

16. If the complete skeleton of the specimen belonging to Jaw Q was examined, which of the following characteristics would it be expected to have?

- (a) longitudinal and transverse arches of the foot
- (b) small outer condyle of the femur at the knee joint
- (c) only one curvature of the vertebral column
- (d) bowl shaped pelvis that is long from top to bottom

**See next page**

Questions 17–19 refer to the diagram of parts of the endocrine system shown below.

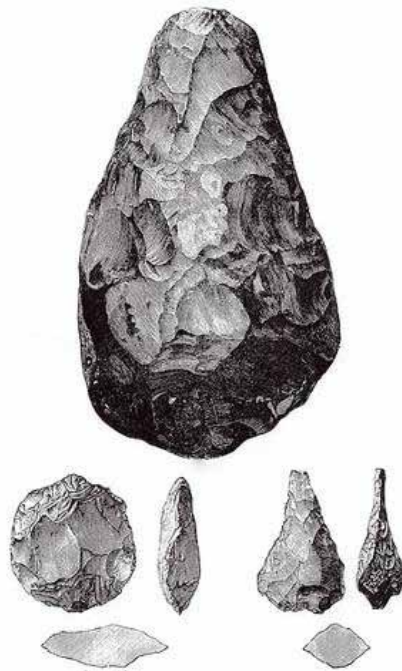


17. Which of the following lists labels correctly the structures of the endocrine system shown in the diagram?
- (a) A = pituitary gland, F = pancreas, E = adrenal glands
  - (b) B = pituitary gland, D = parathyroid glands, F = pancreas
  - (c) C = parathyroid glands, E = pancreas, G = ovaries
  - (d) A = pituitary gland, D = thyroid gland, E = pancreas
18. One of the hormones produced from the structure labelled 'E' is?
- (a) insulin
  - (b) progesterone
  - (c) aldosterone
  - (d) growth hormone



19. One of the target organ(s) for the hormone produced from the structure labelled 'C' is (are) the
- (a) mammary glands.
  - (b) liver.
  - (c) ovaries and testes.
  - (d) kidney.
20. The two enzymes required to produce recombinant DNA are
- (a) DNA ligase and restriction enzyme.
  - (b) DNA polymerase and transcriptase.
  - (c) restriction enzyme and DNA polymerase.
  - (d) transcriptase and DNA ligase.

Questions 21–22 refer to the stone tools shown below.



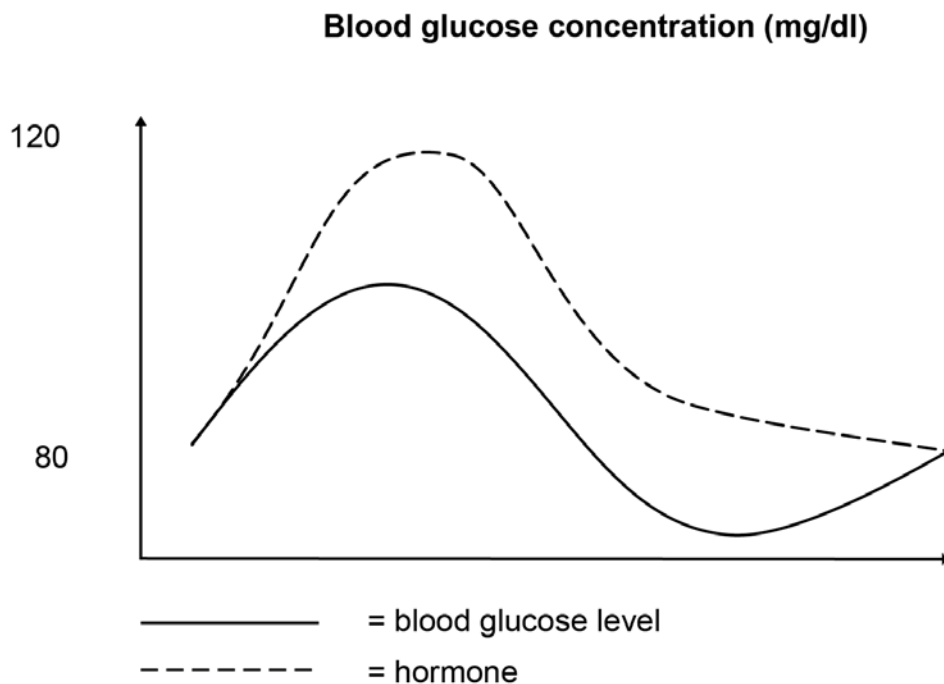
21. To which tool culture do the tools shown above belong?
- (a) Oldowan pebble tools
  - (b) Acheulian hand axes
  - (c) Aurignacian blade tools
  - (d) Magdalenian barbed spears
22. What cultural advance would also be associated with the group of individuals responsible for making the stone tools shown above?
- (a) construction of murals and portable art
  - (b) beginning of farming practices
  - (c) evidence of rituals and burial of the dead
  - (d) beginning to use fire

**See next page**

23. Opponents of euthanasia believe that
- (a) choice is a person's fundamental right.
  - (b) patients are shown more respect when allowed to end their suffering rather than being kept alive against their wishes.
  - (c) the cause of a patient's suffering will never become curable.
  - (d) medical professionals should not be placed in a position where they are required to help a person die.

Questions 24–26 refer to the information and diagram shown below.

Jim has just had his favourite meal of a hamburger, chips and a sweet fizzy drink. His digestive system is going to break down the meal into many small molecules including glucose, which will enter his blood stream and increase in concentration.



24. The dashed line represents the release of a hormone following a meal.
- This hormone is
- (a) insulin.
  - (b) glucagon.
  - (c) cortisol.
  - (d) glycogen.
25. Which one of the following processes can be carried out using the hormone represented by the dashed line?
- (a) release of lipids from storage
  - (b) conversion of glycogen to glucose
  - (c) entry of glucose into cells
  - (d) inhibition of protein synthesis

**See next page**

26. Jim has an older brother, Arthur, who for some time had been tired and lethargic. He was urinating frequently and feeling thirsty. He went to his doctor who diagnosed Diabetes Mellitus type 2, a condition in which the body becomes insensitive to a hormone that regulates blood glucose levels.

Which of the following is **not** a factor associated with Diabetes Mellitus type 2?

- (a) lack of exercise
  - (b) being overweight
  - (c) a diet high in salt
  - (d) low blood pressure
27. In the 1980s, a supposedly fossilised human finger, with completely preserved soft tissue, was found in Texas, USA. This fossil has been said to be a fake because of the highly unlikely possibility of it occurring. This is because
- (a) there were no other fossilised remains found in the area.
  - (b) the soil in the area was not alkaline enough.
  - (c) soft tissues decompose quickly in nature.
  - (d) organisms that live on land do not easily fossilise.
28. A lack of Vitamin D is said to be detrimental to the maintenance of bone density. If a scientist wanted to determine whether this view was supported by scientific evidence, which of the following would be the best method of doing so?
- (a) carry out a survey of people with normal bone density to find out whether they take Vitamin D tablets or not
  - (b) compare the bone density of two groups of people with low bone density after providing only one of the groups with Vitamin D
  - (c) compare the incidence of people with low bone density in two different populations
  - (d) carry out an experiment in which a group of people with normal bone density are exposed to very little sunlight to prevent the production of Vitamin D
29. The hypothalamus is connected to the anterior pituitary gland by
- (a) nerve fibres coming from cell bodies in the pituitary gland.
  - (b) nerve fibres coming from cell bodies in the hypothalamus.
  - (c) chemicals travelling down nerve fibres.
  - (d) chemicals travelling in the bloodstream.

30. A student completing an examination experienced the following sequence of events:
- i. he opened the first page of his examination paper
  - ii. his heart rate began to increase rapidly
  - iii. he began to write his first answers
  - iv. his heart rate decreased back to normal levels

Which of the following correctly links the events above to the branches of the nervous system that control them?

	<b>i</b>	<b>ii</b>	<b>iii</b>	<b>iv</b>
(a)	somatic	sympathetic	somatic	parasympathetic
(b)	somatic	parasympathetic	somatic	sympathetic
(c)	sympathetic	somatic	parasympathetic	somatic
(d)	parasympathetic	somatic	sympathetic	somatic

**End of Section One**

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

Suggested working time: 90 minutes.

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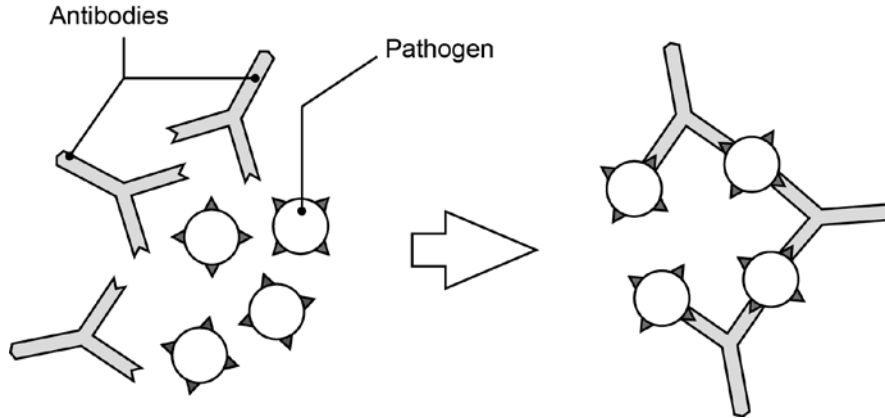
**Question 31****(10 marks)**

- (a) Immunity can be classed as passive or active and natural or artificial. Complete the table below, describing the different types of immunity. (4 marks)

	<b>Passive</b>	<b>Active</b>
<b>Natural</b>		
<b>Artificial</b>		

**See next page**

(b) The diagram below shows one of the actions of antibodies on pathogens.



(i) What action of antibodies does the diagram represent? (1 mark)

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(ii) Describe **three** other ways in which antibodies can act on pathogens to help fight infection. (3 marks)

One: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Two: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Three: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(iii) Name the type of lymphocyte responsible for the production of antibodies. (1 mark)

\_\_\_\_\_

(c) Vaccines are considered a safe and reliable way of increasing the immunity of populations. However, there are risks associated with vaccines.

Identify **one** risk associated with the production or use of vaccines. (1 mark)

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## Question 32

(12 marks)

An investigation was carried out into the effects of administering the hormone thyroxine to patients with a malfunction of the thyroid gland. Two groups of patients were treated; Group A received the hormone and Group B received a placebo. The basal metabolic rate (BMR) of the patients in the two groups was taken over a period of three weeks.

All patients in both groups began with a similar BMR which averaged 30% below normal. After three weeks, patients in Group A had raised their BMR on average to 1% below normal. Group B still had an average BMR of 30% below normal.

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

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- (b) A placebo is an ineffective treatment for a medical condition. It is intended to ensure that the patients don't know whether they are receiving the effective treatment or not and therefore removes any potential psychological effect.

What role does a placebo play in a scientific experiment? (1 mark)

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- (c) Apart from those mentioned in the experiment, suggest **two** variables that would need to be controlled to ensure that this experiment was reliable. (2 marks)

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(d) (i) Name the condition these patients were suffering from. (1 mark)

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(ii) State **two** symptoms, apart from low BMR, that they would be displaying before treatment. (2 marks)

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(e) To maintain thyroid function and a normal BMR, a series of events must take place involving the thyroid gland and its interaction with two other structures in the body. Describe the series of events involving the thyroid gland and these two other structures that would occur to prevent a healthy person's BMR from dropping to below normal levels. (5 marks)

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Question 33

(12 marks)

Identical twins Ross and Richard, aged 45, are taking part in a study in epigenetics. Both men have the inherited condition myopia, commonly known as short-sightedness. Ross has very severe myopia and needs to wear glasses all the time. Richard has mild myopia and only needs to wear glasses while driving.

- (a) Describe why Ross and Richard are considered good subjects for a study in epigenetics. (2 marks)

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- (b) As part of the study, Ross and Richard had a profile of their DNA taken. Name and describe the process scientists would have used to profile their DNA. (5 marks)

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- (c) Using the theory of epigenetics, explain why Ross and Richard have different degrees of severity of myopia. (3 marks)

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- (d) During the study it was shown that Ross and Richard actually had several different physical traits. Another set of twins in the study, Michelle and Mia, aged three, were found to have hardly any differences in their physical traits. Describe how the theory of epigenetics explains this. (2 marks)

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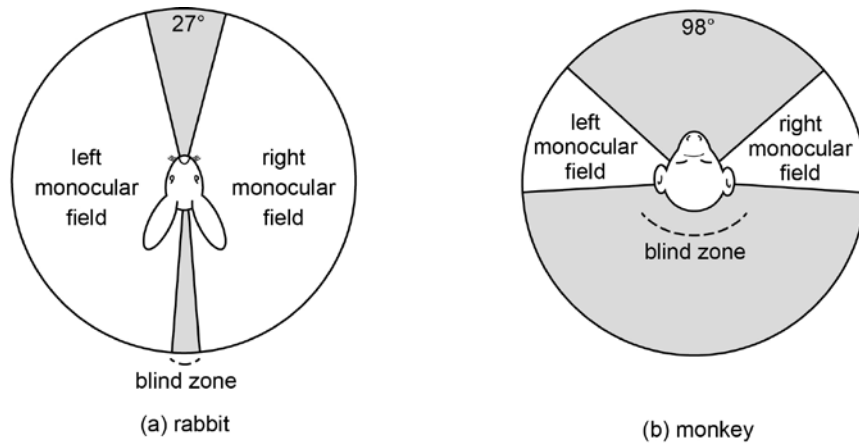
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Question 34

(9 marks)

Part (a) of this question refers to the diagrams below, which show the vision of a rabbit compared with that of a monkey.

(3 marks)



(a) Name the type of vision shown by the monkey.

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Compared with the rabbit what advantage does the monkey gain by having this type of vision?

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Apart from the type of vision shown in the diagram, describe **one** characteristic associated with vision that the majority of members of the Primate order display.

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- (b) Complete the table below, describing the evolutionary trends that occur within the Primate order. (3 marks)

Characteristic	Evolutionary trend
Mobility of digits of the hand	
Gestation	
Shape of molar teeth	

- (c) It is believed that around 5–6 million years ago, changing climatic conditions in Africa caused changes in the landscape. These changes enabled the evolution of an upright stance in the first hominin individuals to occur.

- (i) Describe how the landscape is believed to have changed around 5–6 million years ago. (1 mark)

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- (ii) Describe **two** survival or lifestyle advantages that an upright stance had in this new environment. (2 marks)

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Question 35

(10 marks)

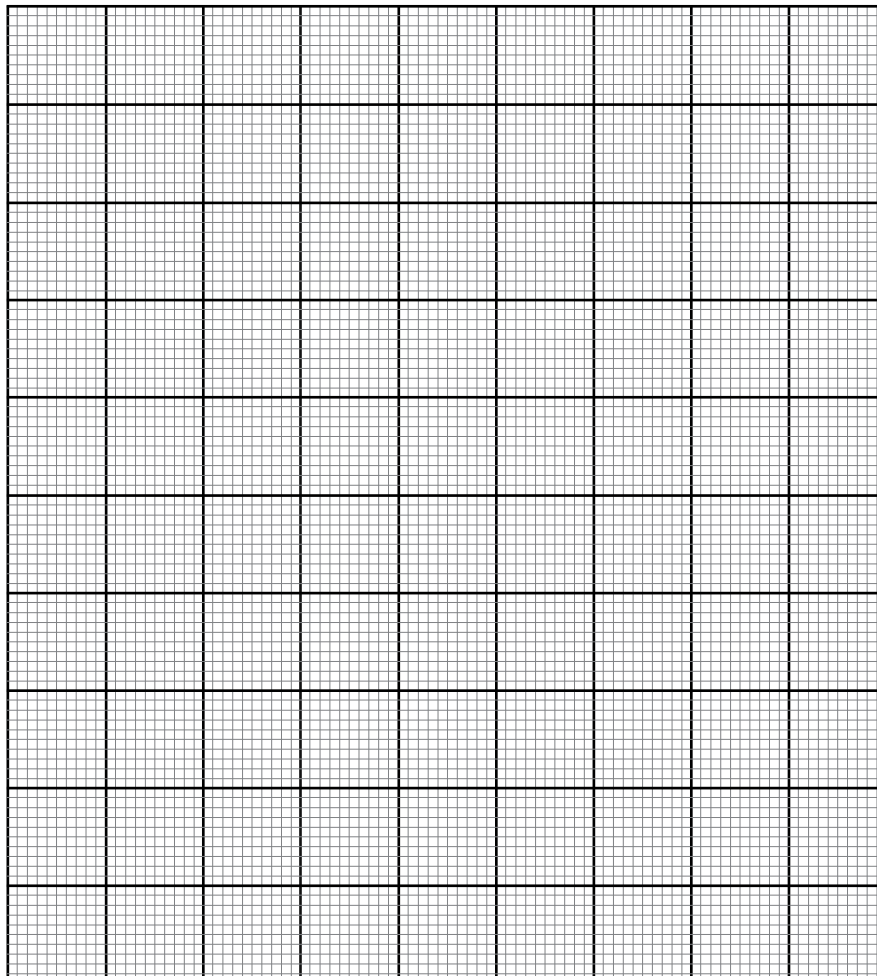
Carbon-14 dating is one commonly used method of fossil dating. The table below shows the ratio of carbon-14 to carbon-12 remaining from the time an organism dies.

Time elapsed since death (years)	Ratio of C <sup>14</sup> to C <sup>12</sup> (arbitrary units)
0	1000
5 730	500
11 460	250
17 190	125
22 920	63
28 650	31
34 380	16
40 110	8

- (a) Graph the data from the table on the grid provided below. (4 marks)

Plot 'Time elapsed since death (years)' on the horizontal axis.

If you wish to have a second attempt at the graph, the grid is repeated 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.



- (b) State whether carbon-14 dating is a form of absolute or relative dating. Explain your answer. (2 marks)

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- (c) The half-life of  $C^{14}$  is 5 730 years. (2 marks)

Define the term 'radioactive half-life'.

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Use the data from your graph to estimate the age of a fossil with a ratio of 375  $C^{14}$  to  $C^{12}$ .

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- (d) Two artifacts were found in the same location: a stone tool, which had not been previously disturbed; and a wooden handle. (2 marks)

Name the artifact that could be dated using the carbon-14 technique.

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Name a method that could be used to determine the age of the other artifact.

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**Question 36**

**(12 marks)**

- (a) The major sources of new variations in a gene pool are mutations. Although they can occur in any cell of the body, mutations occurring in only one type of cell result in changes to allele frequencies in a gene pool. Name the type of cell and describe how mutations in these types of cells can cause changes in allele frequencies in a gene pool. (2 marks)

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- (b) Members of a single gene pool become isolated from each other preventing gene flow between the two groups. Eventually the frequencies of two alleles of a particular gene in the two separate gene pools become significantly different from one another.

Explain how natural selection contributes to this difference in allele frequency. (4 marks)

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- (c) Name **two** types of barriers to gene flow that may have caused human populations to become isolated from each other in the past. Provide an example of each type. (4 marks)

	Barrier to gene flow	Example
1.		
2.		

- (d) The change in allele frequencies in gene pools is also affected by another evolutionary mechanism called random genetic drift.

Describe **two** ways in which random genetic drift differs from natural selection in its effect on changes in allele frequencies. (2 marks)

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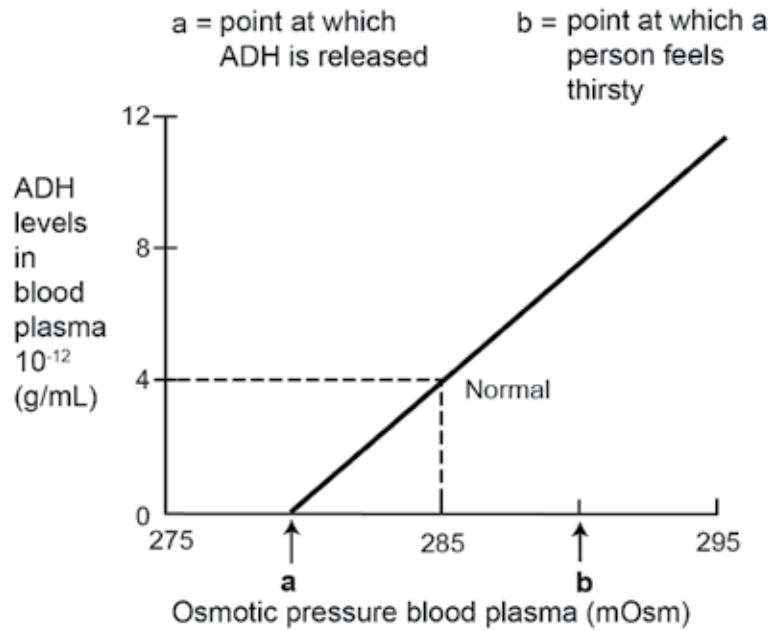
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Question 37

(10 marks)

Part (a) of this question refers to the graph shown below.

The effect of blood plasma osmotic pressure on plasma ADH concentration



The unit mOsm stands for milliosmole or one thousandth of an osmole.

- (a) Given the information in the graph, describe what would be occurring in the kidney to regulate blood fluid composition at a blood plasma osmotic pressure of 285 mOsm.

(2 marks)

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- (b) Water intoxication is a condition in which too much water is present in the body. Complete the table below, outlining the effect of water intoxication on the body fluids. (3 marks)

	Effect of water intoxication
Would blood plasma osmotic pressure be above or below normal?	
Are the intercellular fluids dilute or concentrated?	
Would urine output be increased or decreased?	

- (c) Claire is taking part in a scientific study into the effect of exercise on various body systems. Her blood plasma osmotic pressure was checked using a blood sample taken after she exercised strenuously for 30 minutes. It was measured at 292 mOsm.

- (i) Describe **two** processes that would have occurred in her body during exercise to cause this change in blood plasma osmotic pressure. (2 marks)

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- (ii) Claire felt thirsty after completing the exercise. In which part of the brain is the centre that triggers the thirst mechanism? (1 mark)

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- (iii) How would the information travel from the structure identified in Part (ii) and where would it be processed to make Claire feel that she needed to drink water? (2 marks)

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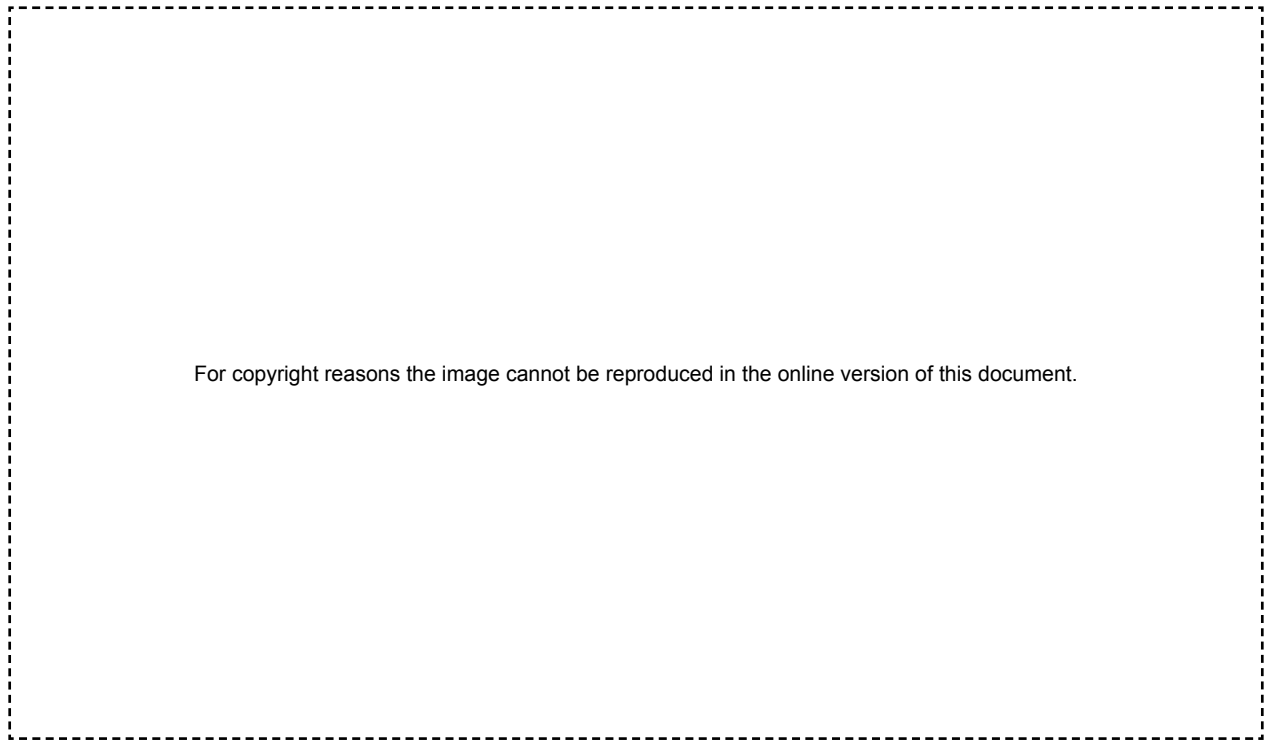
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Question 38

(12 marks)

Part (a) of this question refers to the diagram below, which shows three different types of neurons. (2 marks)



(a) Identify the neuron which is unipolar.

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Describe **one** function of the structure shown in the diagram as the myelin sheath.

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(b) Explain how the transmission of a nerve impulse along a fibre that is myelinated differs from one that is unmyelinated. (2 marks)

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Part (c) refers to the graph shown below.

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- (c) Complete the table below by indicating the number on the graph corresponding to the point at which the event in the action potential would be occurring. (3 marks)

Event	Point indicated on graph
Sodium channels close and membrane is repolarising	
Membrane is at resting state	
Sodium channels open and membrane is depolarising	

**Question 38 (continued)**

- (d) During an action potential there is a period of time known as the refractory period. (2 marks)

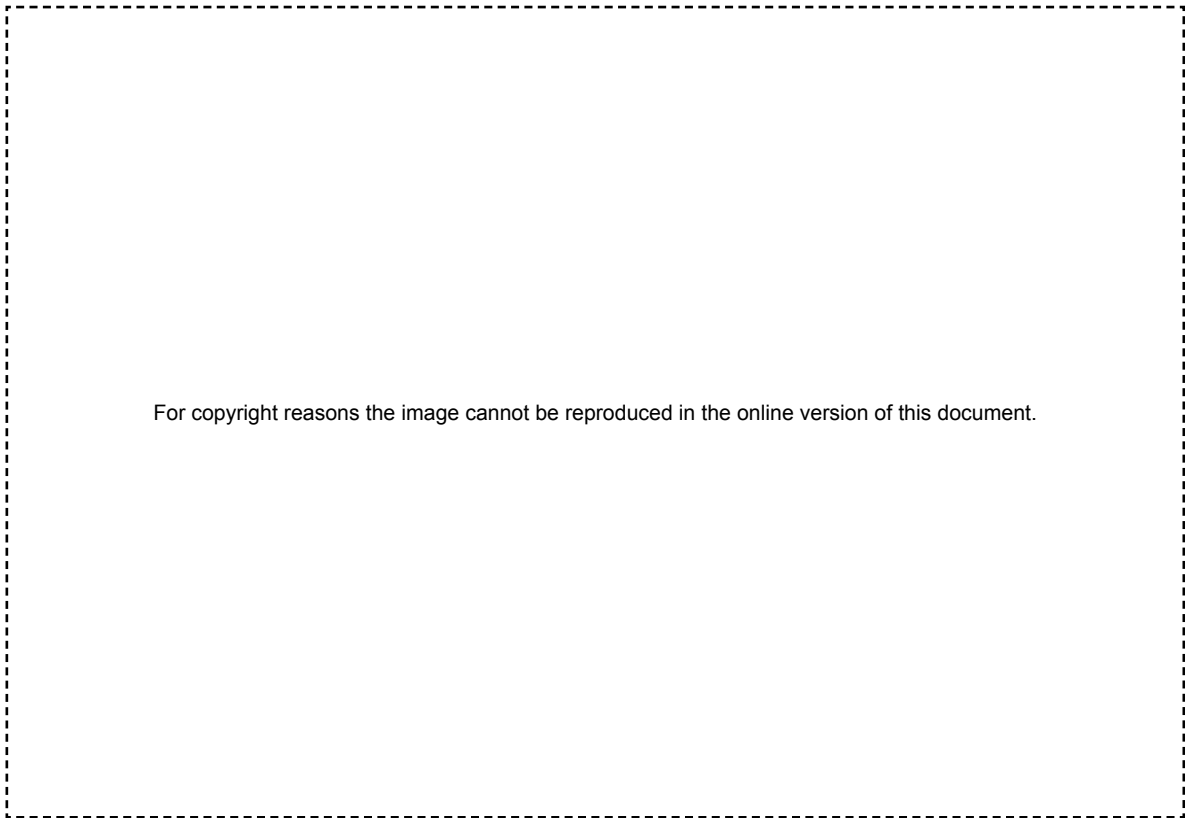
Define refractory period.

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On the copy of the graph below, shade the area known as the refractory period.



- (e) Action potentials are described as ‘all or none responses’. However, it is possible for you to detect the difference between a sheet of paper and a brick being dropped on your foot. Explain why. (3 marks)

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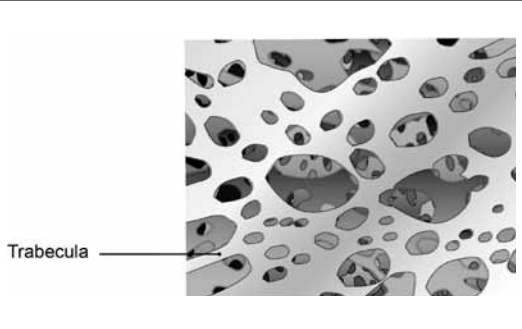
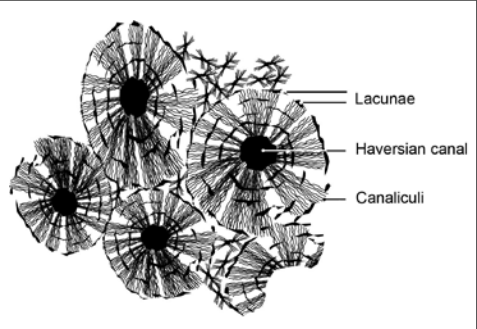
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Question 39

(13 marks)

- (a) The diagrams below show the two types of bone structure. Complete the table, stating the name, location and a function of each type of bone. (6 marks)

		
<b>Name</b>		
<b>Location</b>		
<b>Function</b>		

- (b) A new drug for the treatment of osteoporosis is called Biphosphonate. It works by stimulating osteoblasts and inhibiting osteoclasts in bone.

Outline how osteoclasts and osteoblasts contribute to the change in bone structure.

(4 marks)

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- (c) Osteoarthritis is a disease that is becoming prevalent in many countries. Name **one** type of synovial joint, state one location of the joint in the body and describe the change in function experienced if it is affected by osteoarthritis. (3 marks)

Type of synovial joint	
Location	
Change in function	

**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(s) 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: 60 minutes.

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**Question 40****(20 marks)**

- (a) A major role of the cell membrane is to regulate the transport of materials into and out of the cell. One such process is carrier mediated active transport.

Explain how carrier mediated active transport occurs and identify the cell membrane structures involved. (8 marks)

- (b) DNA codes for the production of proteins in a cell through a series of processes.

Describe these processes in sequence from the coding by DNA to the production of a protein and explain why every protein is different in structure. (12 marks)

**Question 41****(20 marks)**

- (a) State a major function of each of the following parts of the central nervous system.

(5 marks)

- Cerebrum
- Cerebellum
- Hypothalamus
- Medulla oblongata
- Spinal cord

- (b) Both Alzheimer's disease and Parkinson's disease are conditions affecting the central nervous system. Neither of these conditions currently has a cure.

- i. Outline how Alzheimer's disease and Parkinson's disease affect the brain.

(4 marks)

- ii. Research into the treatment of diseases like Alzheimer's disease and Parkinson's disease is often focused on stem cell therapy. Describe how embryonic stem cell therapy could be used to treat diseases of the nervous system. (11 marks)

**See next page**

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

The internal environment of the human body must be maintained within narrow tolerance limits.

- (a) Describe the functions of each component of a negative feedback model in maintaining the body's internal environment within these limits. (6 marks)
- (b) A patient was in a coma for a long period due to damage to his cerebrum. However, he was able to maintain some functions, such as breathing and maintenance of blood pressure, within the normal tolerance limits without the use of medical intervention.

Using your knowledge of the functions of the brain and negative feedback models, explain how he was able to continue to breathe normally and control his blood pressure even though part of his cerebrum was damaged. (14 marks)

**End of questions**



Question number: \_\_\_\_\_

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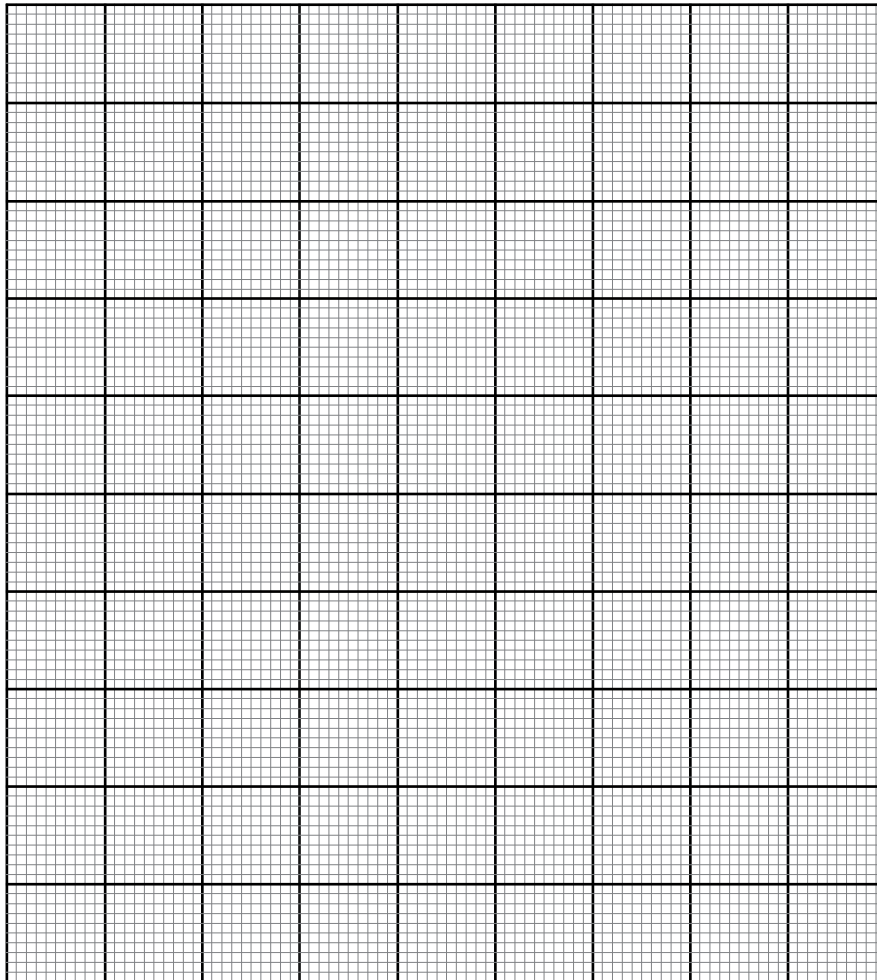








Use the grid to answer Question 35(a) if you have cancelled your first attempt.



## ACKNOWLEDGEMENTS

### Section One

- Questions 1–3** Adapted from: Lawson, R. (2007, December 26). *Spinal nervous pathway* [Diagram]. Retrieved January, 2012, from [http://wikieducator.org/Nervous\\_System\\_Worksheet](http://wikieducator.org/Nervous_System_Worksheet). Used under a Creative Commons Attribution-Share Alike 3.0 Unported Licence.
- Questions 8–9** Diagram of skeletal muscle adapted from: Curriculum Council. (2009). *Human Biological Science Stage 3 sample examination, 2010* [Unpublished paper]. Osborne Park: The Council, p. 19.
- Questions 12–13** Diagram of pentadactyl limbs of four different vertebrates adapted from: Curriculum Council. (2009). *Human Biological Science Stage 3 sample examination, 2010* [Unpublished paper]. Osborne Park: The Council, p. 24.
- Questions 15–16** Adapted from: Maizels, D. (1994). *Comparison of hominid lower jaws* [Diagram]. Retrieved January, 2012, from [www.terrebonneonline.com/b2humev.htm](http://www.terrebonneonline.com/b2humev.htm).
- Questions 17–19** Adapted from: Endocrine system [Diagram]. In American Medical Association. (n.d.). *Atlas of the human body*. Retrieved February, 2012, from [www.ama-assn.org/](http://www.ama-assn.org/).
- Questions 21–22** Diagram of stone tools adapted from: Page, W. (Ed.). (1912). *Victoria history of the County of Kent, Volume 1*. London: St. Catherine Pr. Retrieved January, 2012, from [www.macroevolution.net/](http://www.macroevolution.net/).
- Question 24–26** Graph of blood glucose levels by courtesy of the examining panel.

### Section Two

- Question 31(b)** Adapted from: *The actions of antibodies on pathogens* [Diagram]. Retrieved January, 2012, from <http://leavingbio.net/The%20Human%20Defence%20System-web-2.htm>.
- Question 34(a)** Adapted from: Comparison of the vision of a monkey and a rabbit [Figure 3]. In J.W. Bradbury, & S.L. Vehrencamp. (1998). *Principles of animal communication*. Sunderland, MA: Sinauer Associates. Retrieved January, 2012, from <http://openlearn.open.ac.uk/mod/oucontent/view.php?id=398764&section=3.4>.
- Question 37(a)** Diagram adapted from: Lote, C. Water balance. In C. Blakemore, & S. Jennett. (Eds.). (n.d.). *Oxford companion to the body*. Oxford/New York: Oxford University Press. Retrieved January, 2012, from [www.answers.com/topic/water-balance-1](http://www.answers.com/topic/water-balance-1).
- Questions 38(a)** Adapted from: *Motor neurons* [Diagram]. Retrieved January, 2012, from [www.tutorvista.com/content/biology/biology-iv/nervous-coordination/neurons-types.php](http://www.tutorvista.com/content/biology/biology-iv/nervous-coordination/neurons-types.php).
- Questions 38(c) and (d)** Adapted from: *Action potential – membrane potential changes over time* [Graph]. Retrieved January, 2012, from <http://starklab.slu.edu/PhysioLab/NKPhysioNervesAnswerKey.htm>.
- Question 39(a)** Adapted from: Bone structure 1 [Diagram]. In *Mosby's medical dictionary* (8th ed.). St Louis, MO: Mosby/Elsevier. Retrieved February, 2012, from <http://medical-dictionary.thefreedictionary.com/>.
- Adapted from: Gray, H. (1913). Bone structure 2 [Diagram]. In *Gray's anatomy: Descriptive and applied*. Philadelphia: Lea & Febiger, p. 38. Retrieved February, 2012, from [www.biog1105-1106.org/](http://www.biog1105-1106.org/).

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