

Western Australian Certificate of Education

Question/Answer Booklet

HUMAN BIOLOGICAL SCIENCE

Stage 3

Please place your student identification label in this box

Student Number: In figures

--	--	--	--	--	--	--	--	--

In words

Name: _____

Teacher: _____

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, 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.

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of exam	Student Score
Section One: Multiple-choice	30	30	40	30	30	
Section Two: Short answer	9	10	90	100	50	
Section Three: Extended answer	3	2	50	40	20	
					100	

Instructions to candidates

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

Section One: Answer all questions on the separate Multiple-choice Answer Sheet provided. For each question shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. If you make a mistake, place a cross through that square, 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.

- 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(s) 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, 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 for this section is 30 minutes.

1. Type 2 diabetes is best treated
 - (a) with a daily supplement of glucagon.
 - (b) with an insulin pump.
 - (c) through the careful monitoring and control of diet.
 - (d) using gene therapy to replace faulty genes.

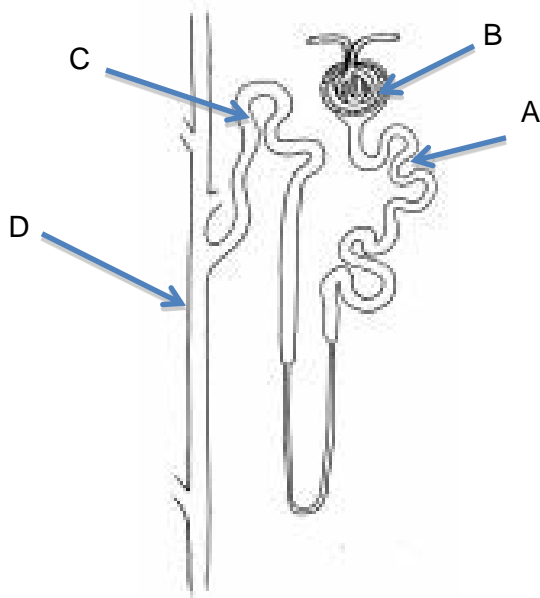
2. Which of the following names the common features of a negative feedback system in the correct order?
 - (a) stimulus, receptor, modulator, effector, feedback
 - (b) receptor, stimulus, modulator, effector, feedback
 - (c) stimulus, receptor, effector, modulator, feedback
 - (d) receptor, stimulus, effector, modulator, feedback

3. The adrenal cortex is responsible for secreting?
 - (a) adrenaline and noradrenaline
 - (b) aldosterone and cortisol
 - (c) epinephrine and norepinephrine
 - (d) insulin and glucagon

4. Which of the following groups of organs and tissues can all be classified as endocrine tissues?
 - (a) pituitary, thyroid, parathyroid, spinal cord
 - (b) adrenal glands, ovary, pancreas, thyroid
 - (c) lungs, pancreas, adrenal glands, testes
 - (d) pituitary, skin, small intestine, thyroid

5. Which of the following statements is TRUE of the autonomic division of the peripheral nervous system?
- (a) Its control is usually involuntary
 - (b) Its general function is in response to stimulus from the external environment
 - (c) There are no synapses in the efferent pathways
 - (d) It only uses the neurotransmitter Acetylcholine

Question 6 refers to the diagram below of the nephron.

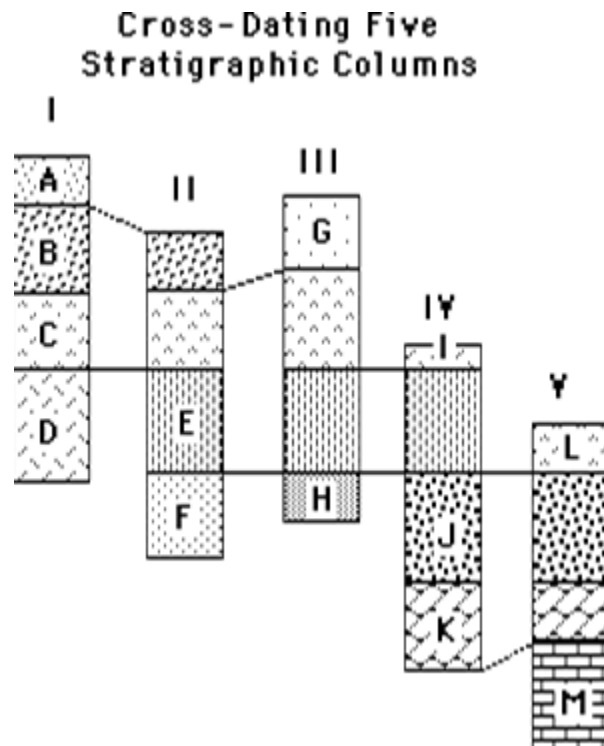


6. Which of the following correctly identifies where the process of reabsorption occurs?
- (a) A only
 - (b) B only
 - (c) A and C
 - (d) A, C and D
7. Glucagon is responsible for
- (a) Allowing glucose entry into cells
 - (b) Promoting fat storage
 - (c) Promoting protein synthesis
 - (d) Promoting gluconeogenesis

8. The respiratory centre is located within the
- (a) medulla oblongata
 - (b) cerebellum
 - (c) hypothalamus
 - (d) pituitary
9. Which of the following changes in the internal environment would cause an increase in breathing rate?
- (a) an increase in the concentration of oxygen
 - (b) a decrease in the concentration of carbon dioxide
 - (c) a decrease in pH
 - (d) an increase in the concentration of body fluids
10. Which of the following lists of symptoms could indicate hypothyroidism?
- (a) unexplained weight gain or loss, slow heart rate, goitre
 - (b) slow heart rate, fatigue, weight gain
 - (c) unexplained weight loss, accelerated heart rate, fatigue
 - (d) increased appetite, fatigue, sweating
11. The Founder Effect is a useful concept that helps to explain why
- (a) in some populations, a particular allele may have an unusually high frequency.
 - (b) populations migrating to a new area will increase their gene pool.
 - (c) small populations are more affected by evolutionary forces than large populations.
 - (d) some alleles are more affected by an environmental change than others.
12. Which of the following human characteristics is an example of polygenic inheritance?
- (a) sickle cell anaemia
 - (b) ABO blood type
 - (c) gender
 - (d) eye colour

- 13 Which of the following is an example of epigenetics in operation?
- (a) The addition of a methyl group to nucleic histones.
 - (b) A diet rich in Omega-3 fatty acids increases the rate of DNA transcription.
 - (c) People of Jewish heritage have a greater chance of inheriting Tay-Sach's disease.
 - (d) The production of melanin increases when a person increases their exposure to UV radiation.

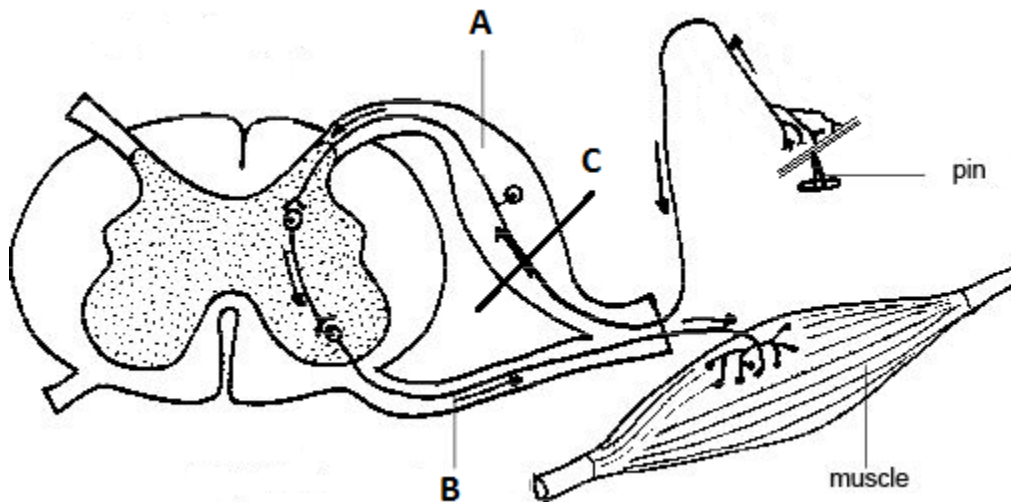
Question 14 refers to the illustration below:



14. Using the method of stratigraphy, which of the following statements regarding the ages of the sedimentary rock layers is correct
- (a) K is the oldest layer, A is the youngest layer, B is older than E
 - (b) M is the oldest layer, E is older than K, G is younger than E
 - (c) M is the oldest layer, H is older than I, B is younger than E
 - (d) K is older than L, C is younger than E, H is younger than I

15. Which of the following statements concerning radiocarbon dating is CORRECT?
- (a) It measures the age of sediments and strata in which the fossils are located.
 - (b) It relies upon Carbon 12 having a half-life of approximately 11,000 yrs.
 - (c) Substances tested must be organic in nature.
 - (d) It can only date fossils older than 250,000 yrs BP.

Questions 16 and 17 refer to the diagram below of spinal reflex arc.

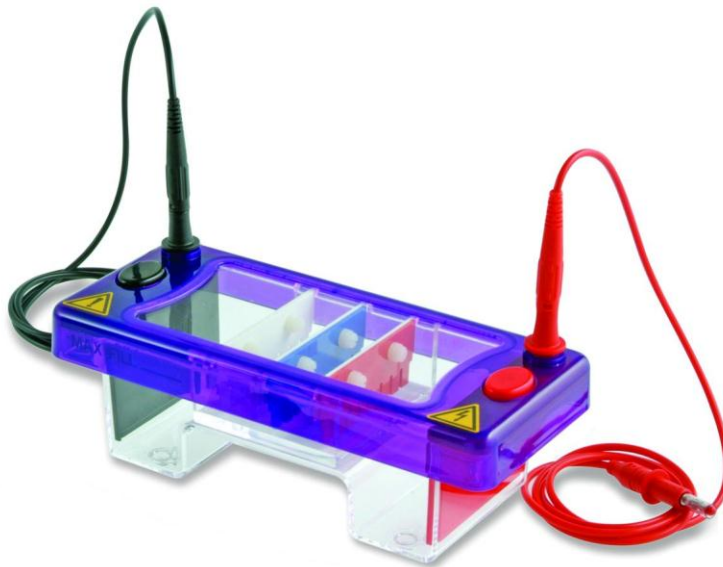


16. The structures labeled A and B are
- (a) A: Dorsal Root B: Motor Neuron
 - (b) A: Ventral Root B: Connector Neuron
 - (c) A: Dorsal Root B: Ventral Root
 - (d) A: Spinal Nerve B: Effector
17. A blockage at the point labelled C would result in the person being
- (a) unable to move freely but still able to feel a stimulus.
 - (b) unable to move or respond at all and unable to feel a stimulus.
 - (c) unable to respond in a reflex manner but still able to move voluntarily.
 - (d) able to perform a reflex response but unable to move voluntarily.

18. A regulator gene could
- (a) ensure that t-RNA assembles the correct sequence of amino acids when producing proteins.
 - (b) promote the production of RNA-polymerase.
 - (c) prevent and correct errors in the DNA base sequence.
 - (d) produce proteins that will prevent transcription.
19. An efferent neuron from the somatic division of the nervous system will
- (a) carry impulses from a sensory receptor to the brain.
 - (b) help promote movement in a skeletal muscle.
 - (c) affect the activity of body organs.
 - (d) provide feedback from body organs to the sensory cortex in the cerebrum.
20. Which of the following statements is INCORRECT?
- The epiphysis of a long bone
- (a) has supporting structures called trabeculae.
 - (b) is made of compact bone and forms the shaft of that bone.
 - (c) may be covered with smooth cartilage.
 - (d) contains red marrow.
21. Parkinson's Disease is characterized by
- (a) muscle wasting and difficulty with breathing.
 - (b) uncontrolled movements and swelling of joints.
 - (c) muscle tremors and some difficulty when walking.
 - (d) slow speech patterns and rolling movements of the head.
22. Alzheimer's Disease affects
- (a) the production of myelin in neurons of the central nervous system.
 - (b) the cerebellum and thereby coordinated movements.
 - (c) areas in the frontal cortex of the cerebrum.
 - (d) a variety of homeostatic mechanisms in the hypothalamus.

23. Osteoporosis can be treated by
- (a) a programme of weight-bearing exercise and dietary supplements.
 - (b) tissue regeneration of cartilage in key joints.
 - (c) surgery that replaces damaged joints with artificial implants.
 - (d) an increase in thyroxine and parathyroid hormone blood levels.
24. In the pursuit of curing genetic diseases, **gene therapy** is best described as
- (a) identifying and selecting embryos with normally functioning genes and only making those available for implantation.
 - (b) the introduction of a normal functioning gene into the relevant cells of patients with faulty DNA.
 - (c) the capacity to control regulator and promoter genes in cells.
 - (d) the use of bacterial genomes in the production of proteins such as insulin.

Question 25 refers to the illustration below of a machine commonly used in a genetics laboratory.



25. This piece of equipment
- (a) uses an electric current to determine the sequence of bases in a DNA sample.
 - (b) requires solutions of bacteria, ligases and restriction enzymes.
 - (c) produces a pattern of bands that can be used to provide a DNA profile.
 - (d) produces large quantities of DNA from a small sample.

26. Which of the following is NOT a part of the ***polymerase chain reaction*** process?
- (a) The use of a heat stable polymerase, usually Taq polymerase.
 - (b) RNA molecules are used as templates for the DNA sequence.
 - (c) Heating the DNA to around 98° C causing the two strands of the double helix to separate.
 - (d) The introduction of short strands of DNA called “primers”.
27. In primates, the olfactory-optical shift
- (a) refers to an increased reliance on the sense of smell.
 - (b) occurred once Hominins developed bipedalism.
 - (c) occurs in individuals as they mature and develop.
 - (d) is reflected in the evolutionary trend of reduced prognathism.
28. The Australopithecines
- (a) exhibited an upright stance and bipedalism.
 - (b) demonstrated little prognathism.
 - (c) had a complex tool culture.
 - (d) had a larger cranial capacity than modern humans.
29. The major environmental force driving the evolution of the Hominins appears to have been
- (a) a gradual cooling of the earth resulting in several ice ages.
 - (b) rising sea levels that isolated some populations.
 - (c) a shift from predominantly forest surroundings to grasslands.
 - (d) reduced volcanic activity.
30. Which of the following is NOT a primate evolutionary trend?
- (a) Increased cranial capacity.
 - (b) Reduced periods of gestation.
 - (c) Increased mobility of the digits.
 - (d) Increased lengths of parental care.

End of Section One

Section Two: Short answer 50% (100 Marks)

This section has **ten** questions. Answer **all** 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.

Suggested working time for this section is 90 minutes.

Question 31

(13 marks)

- (a) Complete the table below. For each hormone listed indicate which lobe of the pituitary gland the hormone is released from, the target organ and its main effect. (6 marks)

Hormone	Released from	Target organ	Main effect/s
Antidiuretic hormone (ADH)			
Growth hormone (GH)			

- (b) Explain why the posterior lobe of the pituitary gland is not considered a true gland (3 marks)

(c) The adrenal glands are endocrine organs involved in the regulation of blood sugar levels.

(i) What are the hormones secreted from the adrenal glands in response to a decrease in blood sugar levels. State from which part of the adrenal gland the hormones are secreted. (2 marks)

(ii) In response to a high carbohydrate meal, what do the following organs do to maintain homeostasis? (2 marks)

Pancreas _____

Liver _____

Question 32

(10 marks)

(a) Draw a **labelled** diagram illustrating the structure of the cell membrane. (4 marks)

(b) One of the main functions of the cell membrane is to regulate substances that pass into and out of the cell. Diffusion is one of the mechanisms by which this membrane transport occurs. Explain how the structure of the cell membrane facilitates this function? (2 marks)

(c) Compare the actions of a steroid hormone with the actions of a protein hormone. (4 marks)

Question 33**(13 marks)**

A pharmaceutical company was investigating the possibility of a new drug for the treatment of patients with heat stroke or hyperthermia. The designed effect of the drug was to increase the skin blood flow of the patients within minutes of administering the drug intra-venously.

In order to test the efficacy of the drug a trial was conducted in which patients admitted to the emergency rooms of hospitals with heat stroke were asked if they wished to participate. A total of 180 patients agreed to take part over the duration of the trial.

Participants were put in to one of two groups. One group of patients would receive an intra-venous injection of the new trial drug and the other group would receive an intra-venous injection of saline (sterile salty water). The normal protocols for treating patients with heat stroke were also carried out for both experimental groups. Each group had 90 individuals.

The skin temperature of participants was recorded on their administration to the ER and every ten minutes after their intra-venous injection. A summary of this data is included in the table below.

Examine the data presented and answer the questions that follow.

The effects of new drug on lowering body temperature of patients suffering heat stroke

Treatment group	Number of patients	Average Temperature (°C) on admission	Average Temperature (°C) following administration of drug or saline					
			10 min	20 min	30 min	40 min	50 min	60 min
New drug	90	40.8	39.9	38.6	37.5	37.3	37.2	37.2
Saline	90	40.6	39.9	39.3	38.7	38.2	37.8	37.4

(a) (i) State the hypothesis for this investigation. (1 mark)

(ii) State the independent variable. (1 mark)

(iii) State the dependent variable. (1 mark)

(b) On the grid provided, construct a graph that can be used to represent this data.

If you wish to have a second attempt at this item, the grid is repeated at the end of the examination booklet. Indicate clearly on this page if you have used the second grid and cancel the working on the grid on this page.

(4 marks)



(c) State the valid conclusion that can be drawn from this investigation (2 marks)

(d) What was the purpose of the group given the saline injection? (1 marks)

(e) The drug was designed to increase skin blood flow. How would this aid in the treatment of patients with heat stroke or hyperthermia? (3 marks)

Question 34

(7 marks)

- (a) The sympathetic and parasympathetic divisions of the autonomic nervous system have differing effects on organs or tissues. Complete the table below to describe the effect sympathetic and parasympathetic stimulation.

(4 marks)

Structure	Effect of sympathetic stimulation	Effect of parasympathetic stimulation
Heart		
Liver		

- (b) What are the neurotransmitters used by the parasympathetic and sympathetic nerve endings?

(1 mark)

- (c) Name ONE similarity and ONE difference between the nervous and endocrine systems

(2 marks)

Question 35

(7 marks)

(a) Discuss the following steps in the process of speciation.

(i) Variation

(1 mark)

(ii) Isolation

(2 marks)

(iii) Selection and speciation

(3 marks)

(b) State the selective agent that maximises the frequency of the sickle cell allele in African populations.

(1 mark)

Question 36

(13 marks)

(a) Complete the table below, listing hominin adaptations to bipedalism

(6 marks)

STRUCTURE	ADAPTATION TO BIPEDALISM
SKULL	(i) (ii)
PELVIS	(i) (ii)
FOOT	(i) (ii)

(b) Compare the tool kit of an early hominin such as *Homo habilis* with that of a later hominin such as *Homo neanderthalensis*.

(4 marks)

(c) Apart from differences in tool culture, describe **three** lifestyle features associated with ***Homo erectus*** that are not part of the accepted lifestyle of ***Homo habilis***.

(3 marks)

Question 37

(11 marks)

(a) Classify the following forms of immunity, using a combination of the terms.

(i) A foetus receives antibodies from the mother across the placenta

(ii) A baby is immunised against Whooping Cough

(iii) Elderly patients are given an injection of antibodies to protect against a flu outbreak

(3 marks)

(b) Compare the action of a **vaccine** with that of an **antibiotic**.

(6 marks)

(c) List **two** ethical considerations that are of concern in the development of new vaccines.

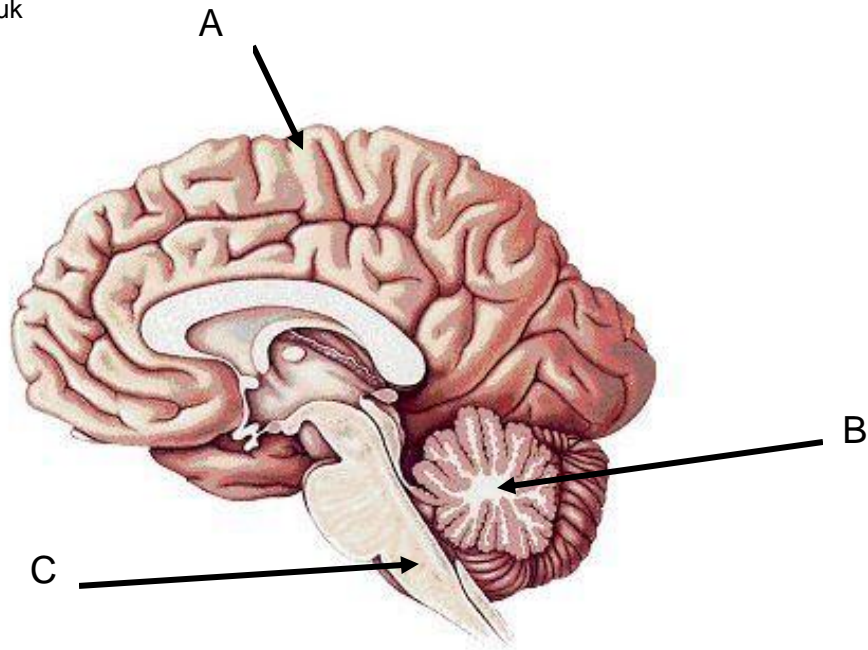
(2 marks)

Question 38

(12 marks)

This diagram is an illustration of a cross-section through the brain. Use this diagram to answer part (a) below.

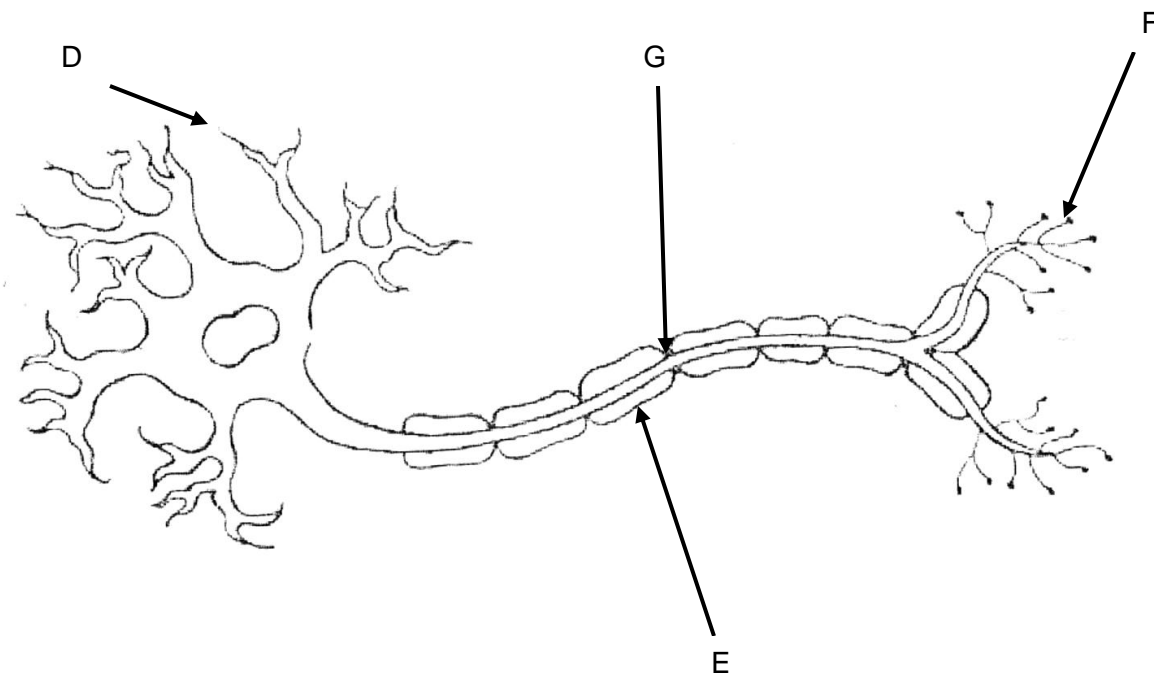
roots.group.cam.ac.uk



- (a) In terms of body movement, what is the role of the structures labelled A, B and C. (3 marks)

STRUCTURE	ROLE IN MOVEMENT
A	
B	
C	

This diagram is an illustration of a motor neuron. Use this diagram to answer parts (b) and (c) below.



- (b) In terms of normal function, what is the role of the structures labelled D, E and F. (3 marks)

STRUCTURE	ROLE IN MOVEMENT
D	
E	
F	

(c) A student researching the term “**saltatory conduction**” stated that the region in the motor neuron labelled G experiences **depolarisation**.

(i) What is meant by the term: **saltatory conduction**?

(ii) Describe the events that occur during depolarisation of a neuron

(4 marks)

(d) In terms of normal neuron function. What is the significance of the following terms?

(i) Threshold stimulus

(ii) Refractory period.

(2 marks)

Question 39

(14 marks)

- (a) Describe the structure of the DNA molecule. (2 marks)

- (b) List two features of the m-RNA molecule that distinguishes it from the DNA molecule. (2 marks)

- (c) In terms of site and purpose, compare the process of ***transcription*** with the process of ***translation***.

	TRANSCRIPTION	TRANSLATION
SITE		
PURPOSE		

(4 marks)

Genetic Engineering has proved useful in the treatment of diabetes through the large scale production of insulin but a modern medical goal is to cure this disease using **Stem Cell Therapy**.

(d) Distinguish between these two techniques.

(6 marks)

End of Section Two

Section Three: Extended answer

20% (40 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 40

(20 marks)

- a) Describe the events occurring along the length of a nephron that provide for the maintenance of body fluids at a constant level.

(7 marks)

- b) Describe the feedback system that restores fluid balance when fluid loss becomes greater than fluid intake.

(13 marks)

Question 41

(20 marks)

- a) Evolution can be defined in terms of the changes to allele frequencies in a gene pool. Discuss **four** evolutionary mechanisms that can act to alter the allele composition of a gene pool.

(8 marks)

- b) Comparative studies can be used to provide evidence for the theory of evolution.

Discuss **four** such comparative studies.

(12 marks)

Question 42

(20 marks)

a) Describe the microscopic structure of bone and skeletal muscle.

(8 marks)

b) Joints may be classified into three main categories: **fibrous**, **cartilaginous** and **synovial** (of which ball & socket is an example).

Using your knowledge of structure, **explain** the role of the structure in the range of movements possible at these joints.

(5 marks)

c) Beginning in the axon terminal of a motor neuron, describe the events that occur to provide movement around a joint.

(7 marks)

End of Questions







Use the grid to answer question 33(b) if you have cancelled your first attempt.

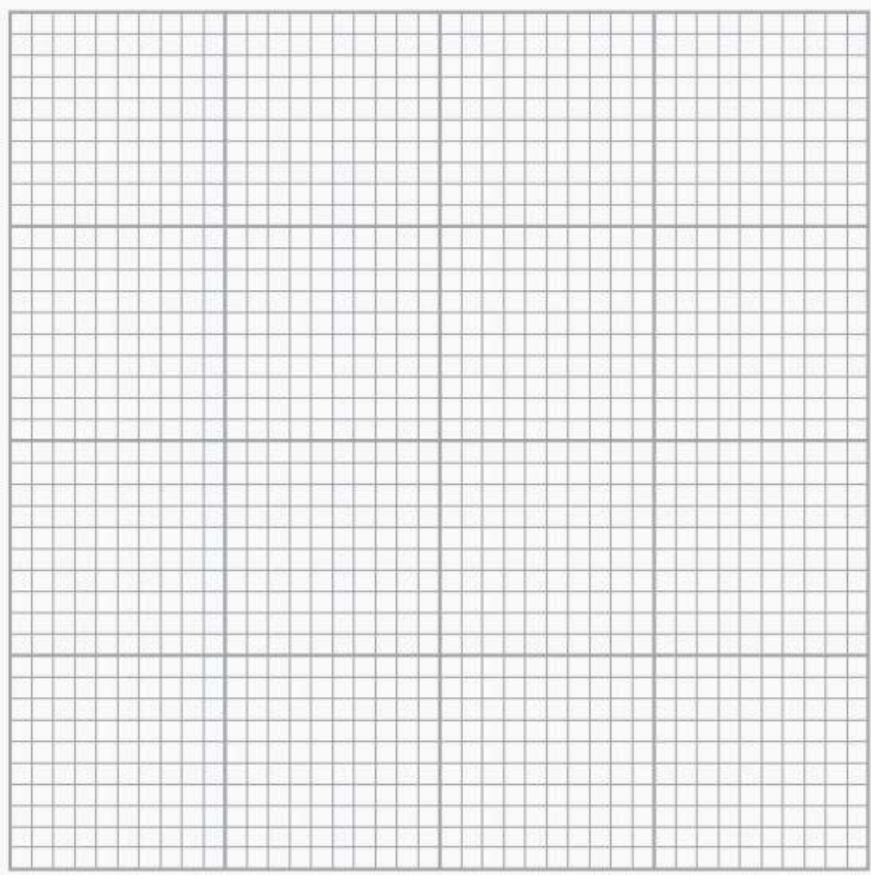


Image from question 6 comes from <http://www.aic.cuhk.edu.hk/web8/Hi%20res/Nephron.jpg>

Image from question 15 comes from
<http://web.mesacc.edu/dept/d10/asb/archaeology/dating/gif/crossdate2.gif>