



**CHURCHLANDS**  
SENIOR HIGH SCHOOL

# HUMAN BIOLOGY

## UNIT 3

### Semester 1 exam

### 2017

Section	Marks	Your mark
Multiple-Choice	60	
Short Answers	100	
Extended Answers	40	
Total	200	

Name: \_\_\_\_\_

Teacher: \_\_\_\_\_

#### ***TIME ALLOWED FOR THIS PAPER***

Reading time before commencing work: Ten minutes  
Working time for the paper: Three hours

#### ***MATERIALS REQUIRED/RECOMMENDED FOR THIS PAPER***

##### **To be provided by the supervisor:**

- This Question/Answer Booklet
- Separate extended answer booklets
  - Part A – also contains the multiple choice answer sheet
  - Part B

##### **To be provided by the candidate:**

- Standard items: Pens, pencils, eraser or correction fluid, ruler, highlighter, ruler.
- Special items: Calculators satisfying the conditions set by School Curriculum and Standards Authority for this subject.

#### ***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 fur

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### Structure of this paper

Section	Suggested working time	Number of questions available	Number of questions to be attempted	Marks	Percentage
SECTION ONE: Multiple-choice	50 minutes	30	All	60	30
SECTION TWO: Short answers	90 minutes	8	All	100	50
SECTION THREE: Extended answers	40 minutes	3	2	40	20
Total marks				200	100

### Instructions to candidates

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2017*. 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 your 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.

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**Section One: Multiple-choice****30% (60 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 50 minutes.

**The following information is needed to answer the next FOUR questions.**

A patient has complained of the following symptoms to their doctor:

- Feeling a lack of energy
- Unexplained weight gain
- Feeling cold, even though the surrounding temperature is around 25°C.

In response, the doctor had the patient's Thyroid Stimulating Hormone (TSH) levels tested over five consecutive days. The patient's results, measured in milli-international units per litre (mIU/L), can be seen in the table below.

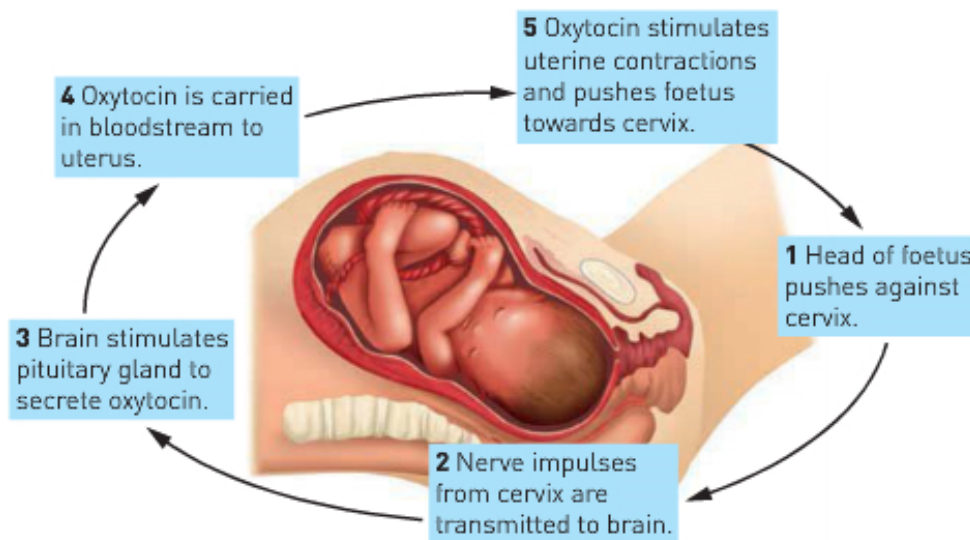
Day	1	2	3	4	5
TSH concentration (mIU/L)	2.0	2.3	2.9	2.7	2.1

A normal range is between 0.4 to 4.0 mIU/L.

1. The range and median for the patient's TSH level was
  - a) 2.0 to 2.9 with a median of 2.4
  - b) 2.1 to 2.9 with a median of 2.3
  - c) 2.0 to 2.1 with a median of 2.9
  - d) 2.0 to 2.9 with a median of 2.3
2. TSH is a hormone secreted by
  - a) the hypothalamus and released from the anterior lobe of pituitary gland.
  - b) the posterior lobe of the pituitary gland and its release is controlled by the hypothalamus.
  - c) the anterior lobe of the pituitary gland and its release is controlled by the thyroid gland.
  - d) the anterior lobe of the pituitary gland and its release is controlled by the hypothalamus.
3. Based on the information the patient provided, the disease the doctor was most likely checking for was
  - a) type 1 diabetes.
  - b) type 2 diabetes.
  - c) hypothyroidism.
  - d) hyperthyroidism.

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4. Choose the two correct words to complete the following sentence.  
*If a patient presented with the same symptoms but had a normal level of TSH present in their blood, the doctor would now need to detect for the presence of \_\_\_\_\_ to determine if the \_\_\_\_\_ gland was dysfunctional.*
- a) insulin, pancreas
  - b) thyroxine, parathyroid
  - c) glycogen, pancreas
  - d) thyroxine, thyroid
5. Which of the following illustrates a negative feedback mechanism?
- a) The loss of excess glucose in urine.
  - b) An increased level of oestrogen in the blood resulting in the release of luteinising hormone.
  - c) The vasoconstriction of the capillaries in the skin to reduce heat loss.
  - d) The release of oxytocin during child birth.
6. Many nerve fibres consist of an axon and its myelin sheath. This myelin sheath is
- a) responsible for the colour of the grey matter in the brain and spinal cord.
  - b) produced by Schwann cells located along the axon.
  - c) continuous all the way along the cell body.
  - d) responsible for the colour of the grey matter in the peripheral nervous system.
7. Which of the following statements about ALL hormones is most correct? They
- a) change the functioning of cells by changing the type or quantities of proteins made.
  - b) activate certain genes in the nucleus.
  - c) change the shape or structure of an enzyme.
  - d) change the rate of production of an enzyme.

Refer to the following diagram, showing the processes involved in labour, to answer the next TWO questions.



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p.79 - Human Perspectives Units 3 & 4 ATAR  
ISBN: 9780170351287

8. In this stimulus-response and feedback process, the effector would be the
- cervix.
  - uterus.
  - pituitary gland.
  - oxytocin.
9. The hormone responsible for stimulating the contractions of the uterus is
- produced in and released from the anterior lobe of the pituitary.
  - produced in the hypothalamus and sent to the anterior lobe of the pituitary via nerve fibres.
  - produced in the hypothalamus and sent to the posterior lobe of the pituitary via nerve fibres.
  - secreted from the hypothalamus and sent to the posterior lobe of the pituitary via blood vessels in the infundibulum.
10. Which of the following statements about the autonomic nervous system is INCORRECT?
- It regulates the activities of smooth muscle, cardiac muscle and glands.
  - It usually operates without conscious control.
  - It is regulated by centres in the cerebral cortex, hypothalamus and the medulla.
  - It contains motor and sensory nerve fibres.

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**Refer to the list below to answer the next question. This information shows some normal physiological changes in the human body.**

- A. Dilation of pupils.
- B. Increase in heart rate.
- C. Decreased secretion of saliva.
- D. Increased secretion from sweat glands.
- E. Dilation of blood vessels in the skin.
- F. Decreased levels of adrenalin in blood.

11. Which of the changes in the above list would result from stimulation by the sympathetic division of the autonomic nervous system?

- a) A, B, C and E
- b) A, C, D and F
- c) A, B, C, and D
- d) B, C, E, and F

12. Substantial injury to the right cerebral cortex results in loss of:

- a) voluntary muscular movements of the left side of the body.
- b) voluntary muscular movements of the right side of the body.
- c) involuntary muscular movements of the left side of the body.
- d) involuntary muscular movements of the right side of the body.

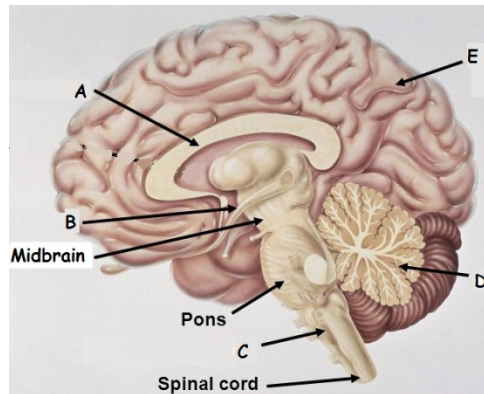
13. *Thermus aquaticus* is a bacteria that is used as a source of enzymes for PCR because it:

- a) speeds up the rate of the PCR process.
- b) naturally lives in hot water.
- c) raises the temperature of the solution.
- d) will survive in water.

14. Bacteria and yeasts are transgenic organisms which are used as “biofactories” to manufacture a variety of useful products. A number of products are listed below. Which ones are produced in “biofactories”?

- i) Antibodies
  - ii) Insulin
  - iii) Human growth hormone
  - iv) Milk proteins
- a) (i) only
  - b) (i) and (ii)
  - c) (ii) and (iii)
  - d) (i) and (iv)

Refer to the diagram below to answer the next question.



15. Which of the following correctly identifies the structures of the central nervous system?

	A	B	C	D	E
a)	Cerebellum	Hypothalamus	Corpus Callosum	Cerebrum	Pituitary Gland
b)	Corpus Callosum	Hypothalamus	Medulla Oblongata	Cerebellum	Cerebrum
c)	Hypothalamus	Corpus Callosum	Medulla Oblongata	Cerebellum	Cerebrum
d)	Corpus Callosum	Hypothalamus	Cerebellum	Medulla Oblongata	Cerebrum

16. The sinoatrial (SA) node or pacemaker of the heart is under autonomic control from which part of the brain?

- a) Medulla oblongata.
- b) Cerebellum.
- c) Cerebral cortex.
- d) Hypothalamus.

17. Which of the following is NOT a property of a reflex?

- a) They occur without any conscious thought.
- b) They occur spontaneously, without a stimulus.
- c) They occur using only a small number of neurons.
- d) They occur in the same way each time they happen.

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18. The chemical that transmits a nerve stimulus via a somatic pathway to a muscle fibre is
- a) noradrenaline.
  - b) cholesterol.
  - c) acetylcholine.
  - d) adenosine triphosphate.
19. Which of the following is NOT a similarity shared between the endocrine and nervous system?
- a) Some hormones are secreted by neurons into the extracellular fluid.
  - b) Both systems are highly specific.
  - c) Some hormones and neurotransmitters have the same effect on the same target cells.
  - d) Some chemicals released from both systems function as both hormones and neurotransmitters.
20. The cerebrospinal fluid (CSF) is important in protecting the nervous system. Which of the following statements about this fluid is correct?
- a) The CSF occupies a space between the layers of the meninges, where the brain is suspended within this fluid.
  - b) The CSF acts as a shock absorber, protecting the whole nervous system.
  - c) The CSF is formed from blood and it circulates through the peripheral nervous system.
  - d) During its circulation, the CSF takes nutrients to the cells of the brain and spinal cord, re-entering the lymphatic system.
21. A footballer, having received a blow to the head, has come off the field. She complains of having blurred vision. The most likely point of contact would have been the
- a) front of the head.
  - b) left hand-side of the head.
  - c) right hand-side of the head.
  - d) rear of the head.
22. A symptom of a person with hyperthyroidism would include:
- a) slow heart rate.
  - b) weight gain.
  - c) intolerance to cold.
  - d) increased appetite.



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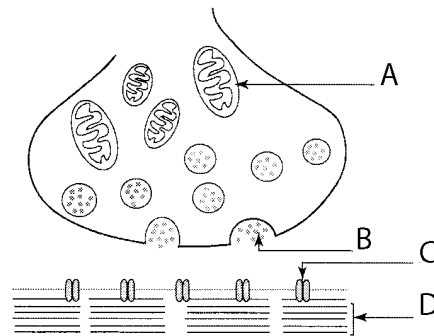
23. An individual suffering from excessive levels of calcium circulating in the blood would most likely have a dysfunctional:

- a) thyroid.
- b) pancreas.
- c) parathyroid gland.
- d) adrenal gland.

24. Using gene therapy to treat a disease would involve:

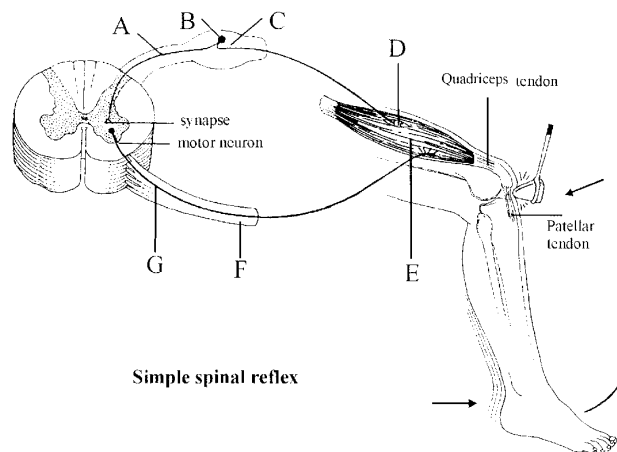
- a) transferring particular proteins into a person with the disease.
- b) injecting various types of blood into a person with the disease.
- c) injecting viruses that destroy certain cells of a person with the disease.
- d) transferring alleles into the cells of a person with the disease.

25. A bite from a cone shellfish (a type of marine animal) injects a toxin into the body of a victim. This toxin binds to neurotransmitter receptors in the synapse. Which of the following letters in the diagram below best represents these receptors?



- a) A
- b) B
- c) C
- d) D

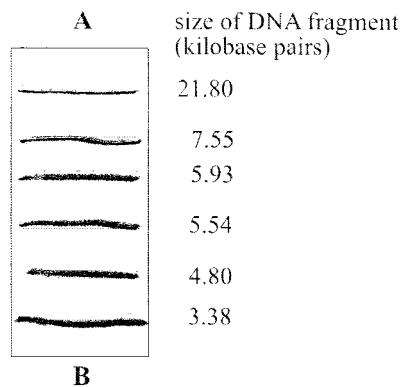
The following question refers to the diagram below:



26. The efferent or motor neuron axon is located at

- a) A
- b) C
- c) F
- d) G

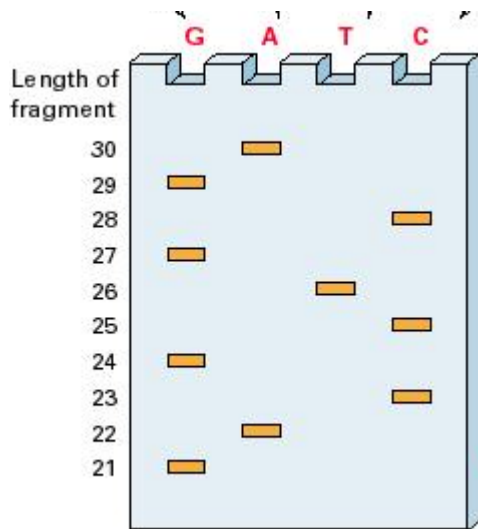
The following DNA profile was obtained from skin cells found at a crime scene. One section of a chromosome from the skin sample was separated using gel electrophoresis.



27. Which of the following statements is **CORRECT**?

- a) The direction of the movement of the DNA fragments is from B towards A.
- b) Three of the DNA fragments must have been inherited from the individual's mother.
- c) The polymerase chain reaction would have been used to multiply the section of the DNA molecule.
- d) The restriction enzyme must have cut the section of the DNA molecule in six places.

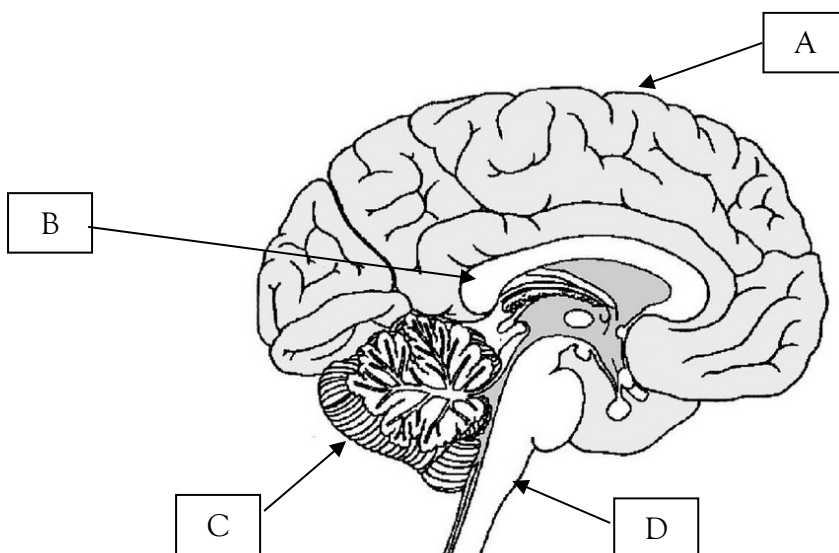
Examine the gel below which was produced during the Sanger method of DNA sequencing.



28. Identify the correct sequence of bases that would be found on the DNA of interest.

- a) AGCGTCGCAG
- b) GGGGAATCCC
- c) GACGCTGCGA
- d) CTGCGACGCT

29. Which part of the brain is responsible for the maintenance of posture and balance?



- a) A
- b) B
- c) C
- d) D

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30. 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 an example of a:

- a) Water soluble amine.
- b) Water soluble steroid.
- c) Lipid soluble amine.
- d) Lipid soluble steroid.

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

This section has **seven (7)** 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 for this section is 90 minutes.

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31.

**(24 marks)**

Scientists wanted to test the hypothesis that increased levels of adrenocorticotrophic hormone (ACTH) during stressful situations could lead to weight gain in humans. It has been acknowledged that glucocorticoids (namely cortisol), are released during times of stress and the presence of these hormones may cause weight gain.

To investigate this theory, scientists exposed the same number of rats (10), who were all one year of age, to increasingly more stressful situations and then allowed them access to an unlimited supply of food pellets for 15 minutes. To induce stress, the rats were kept in isolation and completely restrained by a belt lined with wool, which was appropriately sized, depending on the age and size of the rat. Once the time of restraint had elapsed, the amount of adrenocorticotrophic hormone (ACTH) present in their blood was measured and the average calculated. The average amount of ACTH was measured in picograms per mL of blood. The rats were then freed and allowed access to the food. The scientists recorded the number of pellets that were eaten.

The results from the experiment can be seen below.

	Number of pellets eaten within 15 minutes after release.			
	Trials			
Average amount of ACTH in blood (pg/mL)	1	2	3	Average
30	14	14.25	13.75	14
60	10	10.25	9.75	10
90	8.25	9	8.25	8.5
120	17	19	18	18
150	21	24	22.5	

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(a) Name the independent variable. \_\_\_\_\_ (1 mark)

(b) List three controlled variables that would ensure the test was fair.

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(3 marks)

(c) Complete the table on the previous page by calculating the average number of pellets eaten for the last test. (1 mark)

(d) Plot the results on the graph paper supplied on the next page. (Spare graph grid provided) (5 marks)

(e) State where in the body, glucocorticoids are released from.

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(1 mark)

(f) For each situation listed below, give one reason why the scientists:

(i) measured and calculated the average amount of ACTH.

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(2 marks)

(ii) measured the amount of ACTH rather than the glucocorticoids.

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(2 marks)



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- (g) Using the results of the experiment, describe the effect of increasing ACTH levels from 30 – 90 pg/mL had on the rat’s appetite.

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(2 marks)

- (h) Provide one explanation as to why this effect occurred.

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(2 marks)

- (i) Upon reviewing the procedure of this experiment, an independent scientist claimed, *“The procedure for this experiment was not conducted in an ethical way and the results were invalid given the hypothesis”*.

Explain what the independent scientist meant by this statement.

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(2 marks)

- (j) Cortisol has the ability to pass directly through the membrane of liver cells. State what type of hormone cortisol is and explain how it stimulates the cell to form particular proteins.

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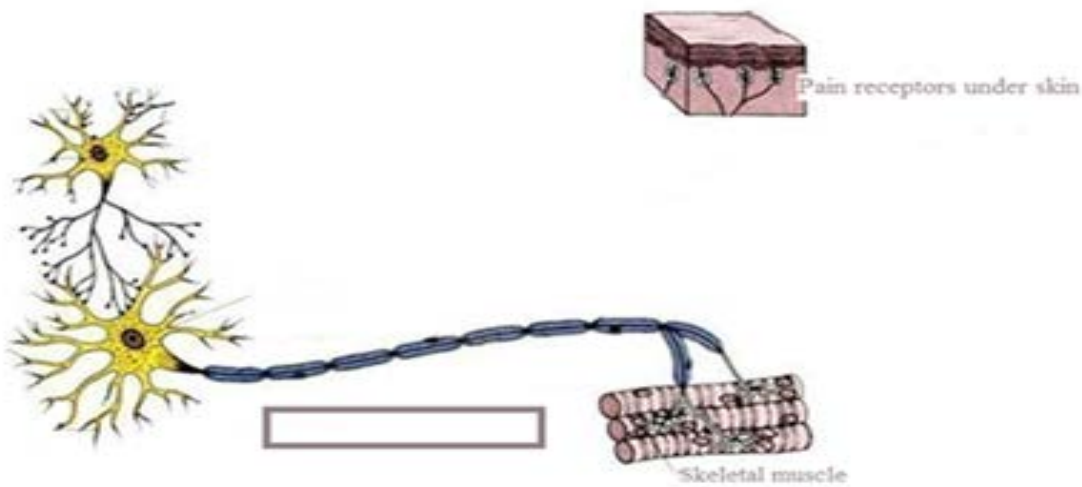
(3 marks)



32.

(15 marks)

- (a) Complete the diagram below of a reflex arc, by drawing a myelinated unipolar neuron in the appropriate space below. (1 mark)



- (b) Indicate with an arrow in the rectangular box above, the direction of the nerve impulse through the axon above the rectangular box. (1 mark)

- (c) Complete the following table.

Part	One Function of the Part
Cell Body	
Dendrites	
Myelin sheath	
Axon	

(4 marks)

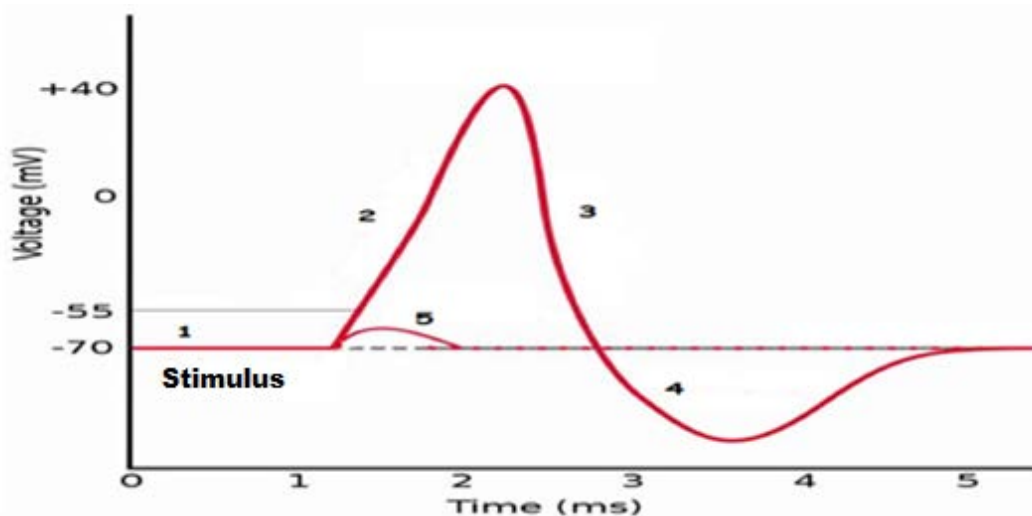
- (d) Label the parts listed in the above table onto the multipolar neuron in the diagram above. (4 marks)
- (e) Label each neuron in the diagram above according to their functional type. (3 marks)
- (f) State which of the neurons above cannot regenerate its axon and state why.

(2 marks)

33.

(14 marks)

Below is an action potential graph, showing the outcome from two different stimuli on the same neuron. Looking at the graph below, answer the questions that follow.



(a) Complete the following table which is referring to the section of the graph numbered 1.

Question	Answer
Is the inside of the cell depolarised or polarised?	
Are the sodium gates open or closed?	
Are the potassium gates open or closed?	
Is the outside of the neuron more positive or negative?	
How many sodium ions are pumped out of the neuron relative to potassium ions?	
How many potassium ions are pumped into the neuron relative to sodium ions?	

(3 marks)

(b) The first stimulus resulted in the line labelled with the number 5. Explain TWO reasons why the potential difference quickly returned to -70mV.

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(2 marks)

- (c) The second stimulus resulted in the line labelled with the numbers 2, 3 and 4.  
State TWO events that could not possibly occur during the phases shown by the sections labelled 2, 3 and 4.

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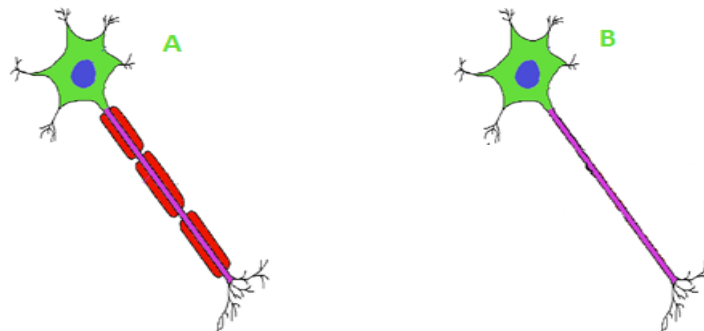
(2 marks)

- (d) Use the graph above to identify the events occurring in the following diagrams. Place the number 1, 2, 3 or 4 in the box highlighting the events that are taking place.

Number: _____	Number: _____

(2 marks)

- (e) Look at the diagram below of the different nerve fibres and answer the questions that follow.



- (i) Complete the following table:

Nerve fibre	Myelinated or unmyelinated?	Found in the grey matter or white matter?
A		
B		

(2 marks)

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(ii) State which of the nerve fibres above would conduct an impulse faster and briefly explain why.

(3 marks)

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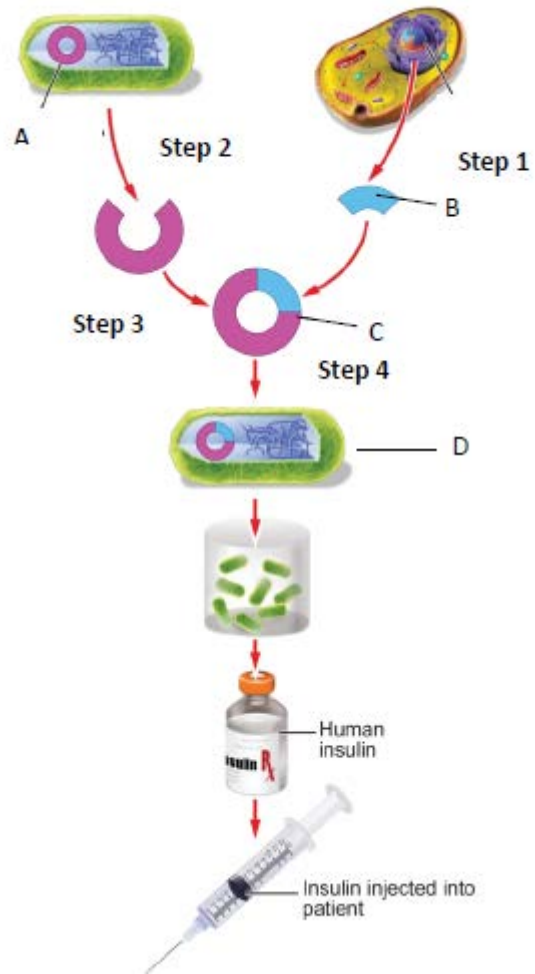
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34.

(15 marks)

With reference to the diagram below



a) Label the following:

A	
B	
C	
D	

(4 marks)

b) In the table below, briefly outline the sequence of events in the production of insulin using biotechnology. (4 marks)

Step number	Description
Step 1	
Step 2	
Step 3	
Step 4	

c) The following questions refer to the regulation of blood glucose levels within the blood.

i. Name the main hormone that is responsible for increasing blood glucose levels in the blood.  
\_\_\_\_\_  
(1 mark)

ii. Where is this hormone produced? Be as specific as possible.  
\_\_\_\_\_  
(1 mark)

iii. Give an everyday example of when this hormone may be produced.  
\_\_\_\_\_  
\_\_\_\_\_  
(1 mark)

iv. Explain the effects of this hormone in order to raise blood glucose levels.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(4 marks)

35.

(15 marks)

Most people can only hold their breath for about one minute before they are forced to take a breath.

- a) Complete the following table summarising how the body regulates gas concentrations within the blood when a person is holding their breath. (7 marks)

Stimulus	
Receptor (name and location)	
Modulator	
Effector(s)	
Response	

- b) Hyperventilation, the rapid and deep breathing in an out, can occur voluntarily or involuntarily. It can occur involuntarily in response to severe pain or extreme fear. Complete the following table to distinguish between the two different efferent nervous divisions that can regulate hyperventilation.

	Names of two different nervous efferent divisions	
	a.	b.
Neurotransmitter(s)		
Effector(s) / target organ(s)		
Effect of neurotransmitter on effector(s) / target organ(s)		
The number of neurons per pathway from the CNS to the effector		

(5 marks)

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c) Explain how voluntary hyperventilation allows the free diver to stay underwater for longer.

(3 marks)

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36.

(5 marks)

A marathon runner is just about to complete a race in hot weather and he is sweating, feels thirsty and his skin is red and hot.

Complete the following table to summarise the body's symptoms to the exercise in the hot environment.

Symptoms	Stimulus	Receptor	Modulator	Effector	Response
Red and hot skin	Increased body temperature	Thermoreceptor	a.	Hypothalamus	b.
Sweating	Increased body temperature	Thermoreceptor	c.	Sweat glands	Sweat released onto the surface of this skin
Thirsty	Increased osmotic pressure	d.	Hypothalamus	e.	Conscious decision to have a drink

37.

(5 marks)

The pituitary gland is sometimes referred to as the "master gland" however; it could be argued the hypothalamus should have this title. Describe how the hypothalamus controls the secretion of hormones from the anterior and posterior lobe of the pituitary gland.

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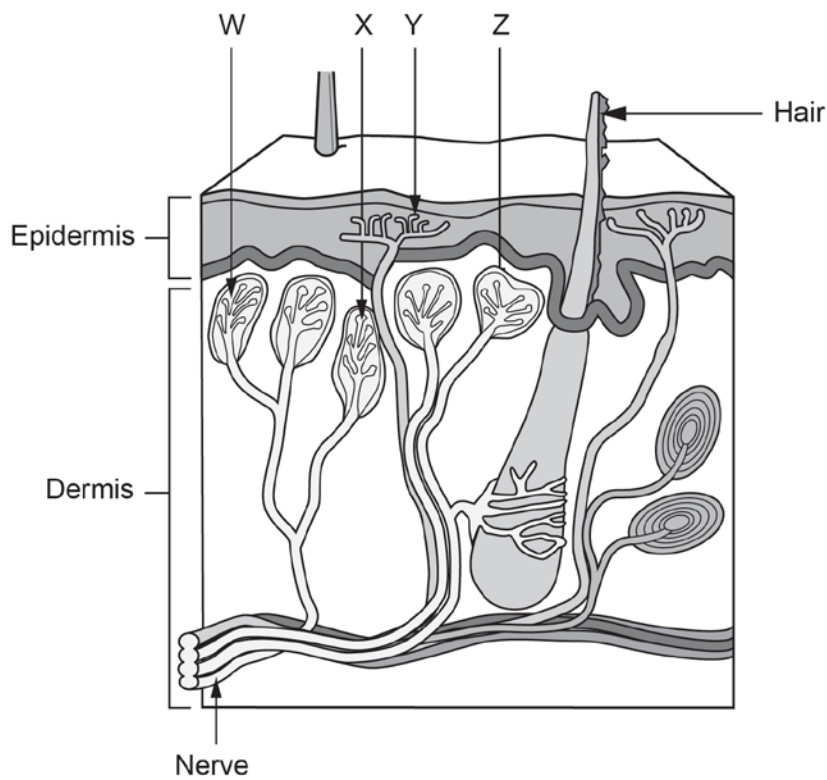
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38. The following question refers to the diagram of the skin below.

(7 marks)



a) Receptor W is close to the skin surface is said to be “adaptable”. What does this mean?

(1 mark)

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b) Identify the difference between receptors labelled Y and X.

(4 marks)

Receptor	Type of Receptor	One Function
Y		
X		

c) How do you think the concentration of receptor X would be different when comparing your fingertips to the heel of your foot? Explain your answer.

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(2 marks)

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

This section contains **three (3)** questions. You must answer **two (2)** questions. Make sure you clearly indicate which question you are answering and 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 more space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Write the number of the question(s) that you are continuing to answer at the top of the additional space 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: 40 minutes.**

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39.

**(20 marks)**

The neurotransmitter, dopamine stimulates target neurones in the same manner as an amine hormone would affect a target cell. It can have an excitatory or inhibitory effect on the action potential of the target neuron. An excitatory or inhibitory effect on the target neuron is influenced by whether the post-synaptic neuron has D1 or D2 receptors. If the neuron has D1 receptors, sodium ion (Na<sup>+</sup>) channels are stimulated to be opened and if the neuron has D2 receptors, potassium ion (K<sup>+</sup>) channels are stimulated to open.

- a) Explain how dopamine would move from the presynaptic neuron, across the synapse, to activate a post synaptic neuron.

(9 marks)

- b) State whether the D2 receptors would cause an excitatory or inhibitory effect on the action potential of the target neuron and describe why this response would occur.

(4 marks)

- c) The constant supply of adrenaline would stimulate the autonomic nervous system. State which division of the autonomic nervous system would be stimulated and describe how six different parts of the body would be affected by this neurotransmitter.

(7 marks)

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40.

**(20 marks)**

Under normal circumstances, homeostatic control mechanisms ensure blood glucose levels and body fluid composition are maintained at a constant level. The night before a triathlon, competitors may consume a large meal high in carbohydrates and they will be required to drink plenty of water during the event to remain hydrated.

(a) Explain how the human body reduces blood glucose levels after a meal high in carbohydrates.

(7 marks)

(b) During the marathon, the competitor's body fluid levels will begin to drop. Explain the physiological and behavioural changes the body will undergo to maintain homeostasis.

(9 marks)

(c) If a person can not regulate their blood glucose levels, they may be suffering from Type 1 Diabetes. Explain the cause and treatments of Type 1 Diabetes.

(4 marks)

41.

**(20 Marks)**

The understanding of the structure and function of DNA has allowed scientists to develop new technologies that can improve the quality of our life and the health of our planet. The Polymerase Chain Reaction and the Sanger method of DNA sequencing are two techniques used by scientists throughout the world today.

a) Name and describe the three main stages of the polymerase chain reaction technique.

(10 marks)

b) Explain the steps involved in DNA sequencing. In your answer, name the synthetic nucleotide and its role in this process.

(10 marks)















