HUMAN BIOLOGY

Unit 3

2016

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
- Multiple Choice Answer Sheet

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 the Schools 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 further.

- ***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	30	30
SECTION TWO: Short answers	90 minutes	8	All	100	50
SECTION THREE: Extended answers	40 minutes	3	2	40	20
			Total marks	170	100

- **Instructions to candidates**

1. The rules for the conduct of Western Australian external examinations are detailed in the *Year 12 Information Handbook 2016.* 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.

- **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: 40 minutes.

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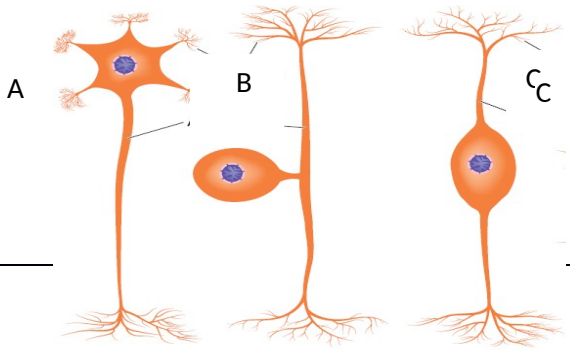
1. The pineal gland is a pea size gland found deep inside the brain, its function is thought to be:
   (a) control of metabolism.
   (b) control of emotions.
   (c) control of sleep patterns.
   (d) control of puberty.

2. EPO, erythropoietin, is made by the:
   (a) stomach.
   (b) adrenal cortex.
   (c) liver.
   (d) kidney.

3. Cytosol is:
   (a) the fluid found in plasma.
   (b) the fluid found inside the cells.
   (c) the fluid found between cells.
   (d) the fluid found in lymph.

- Use the diagram below to answer question 4.



4. Which of the following correctly labels the structural types of neurons shown above.

	A	B	C
(a	multipolar	Bipolar	unipolar
(b	bipolar	multipolar	unipolar
(c)	unipolar	bipolar	multipolar
(d	multipolar	Unipolar	bipolar

5. The difference between white and grey matter within the spinal cord is:
   (a) The white matter is far away from the nerve tracts within the spinal cord whilst the grey matter is closer.
   (b) The grey matter contains the unmyelinated nerve fibres and the white matter contains the cell bodies.
   (c) The white matter contains the dendrites of neurons, the grey matter contains the nerve fibres.
   (d) The grey matter contains the cell bodies of neurons the white matter contains the myelinated nerve fibres.

6. A reduction in the amount of parathyroid hormone would result in:
   (a) osteomyelitis.
   (b) osteoarthritis.
   (c) poor nerve impulse transmission.
   (d) kidney stones.

7. Which of the following is not part of the first line of defence against microorganisms?
   (a) The lining of the respiratory tract.
   (b) The eyelashes.
   (c) The lining of the intestinal tract.
   (d) The inflammatory response.

8. A substance that triggers an immune response is called an:
   (a) Antiviral.
   (b) Antibody.
   (c) Antigen.
   (d) Antihistamine.

9. Which of the following will result from the stimulation of the peripheral chemoreceptors?

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(a) A reduction in the glucose levels of the blood.
(b) An increase in the concentration of CO_2 in the blood.
(c) An increase in blood pressure.
(d) An increase in the water concentration of the blood.

10. Cell replacement therapy can be used when a disorder causes loss of or injury to normal cells. Which disorder could be treated with this kind of therapy?
    (a) Parkinson's.
    (b) Sickle cell anaemia.
    (c) Trigeminal neuralgia.
    (d) Cystic fibrosis

11. Which of the following ions will stimulate the release of a neurotransmitter from an axon terminal?
    (a) Positive potassium ion
    (b) Positive calcium ion.
    (c) Positive Sodium ion.
    (d) Negative chlorine ion.

12. Target cells work by responding to specific hormones when the hormone binds to:
    (a) specific binding sites on the enzymes within the cell.
    (b) receptor proteins in the plasma membrane.
    (c) carrier proteins in the plasma membrane.
    (d) specific binding sites on the golgi body.

13. The nervous and endocrine systems differ in many ways in how they control body functions. Which of the following does not describe a difference?
    (a) speed.
    (b) duration of action.
    (c) intensity of response.
    (d) type of signal.

14. The Corpus Callosum is found just under the cerebrum, its function is to:
    (a) enable communication between the cerebrum and the cerebellum.
    (b) protect the hypothalamus.
    (c) enable the hypothalamus to connect with the pituitary.
    (d) Enables the two sides of the cerebrum to communicate with each other.

15. Viruses:
    (a) contain organelles.
    (b) can reproduce inside a host cell.
    (c) are considered a living organisms.

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(d) have a specific receptor they can attach to.

16. The growth of cells in the muscle is stimulated by:
    (a) Growth Hormone.
    (b) Thyroid stimulating hormone.
    (c) ACTH.
    (d) Gonadotropins.

17. Type II Diabetes is a disorder:
    (a) caused by a deficiency in glucagon secretion.
    (b) that can be diagnosed by decreased glucose levels in the urine.
    (c) caused by damage to the alpha cells in the pancreas.
    (d) where your body cannot use the insulin it produces.

18. What is the function of the connector or relay neuron in a reflex arc?
    (a) To transmit the message from the receptor to the sensory neuron.
    (b) To connect the motor neuron to the motor end plates.
    (c) To bypass the nerve tracts in the spinal cord.
    (d) To connect the sensory neuron to the motor neuron.

19. Bactericidal antibiotics are effective at killing bacterial infections because they:
    (a) stop bacteria from reproducing.
    (b) disrupt protein synthesis.
    (c) disrupt the action of essential enzymes.
    (d) Prevent the bacteria from growing.

20. The role of Heparin is to:
    (a) prevent clotting.
    (b) make the walls of the blood capillaries more permeable.
    (c) increase the blood flow to the infected area.
    (d) attract phagocytes to the infected area.

21. The purpose of “Herd Immunity” is to:
    (a) provide immunity for a small portion of the population.
    (b) prevent outbreaks of deadly diseases.
    (c) eradiate a disease from the World.
    (d) vaccinate a large proportion of the population making it difficult for an infectious disease to spread.

22. Transmission of a communicable disease can occur by:
    (a) physical contact.
    (b) transfer of bodily fluids.
    (c) the use of vectors.

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(d) all of the above.

23. Which of the following statements incorrectly defines the differences between macrophages and lymphocytes?
    (a) Macrophages give non-specific protection but lymphocytes give specific immunity.
    (b) Macrophages show Phage activity, lymphocytes do not.
    (c) Macrophages are larger than lymphocytes.
    (d) Macrophages are in circulation, lymphocytes stay in the tissues.

24. Whilst exercising during the heat of the day the body tries to cool itself by sweating which can lead to dehydration. If the body becomes too dehydrated:
    (a) osmotic pressure of the blood decreases.
    (b) chemoreceptors in the hypothalamus will be stimulated.
    (c) ADH will be increased.
    (d) the permeability of the distal convoluted tubule to water will be reduced.

25. Which of the following best describes the distribution of bodily fluids?

Type of body fluid	**Intracellular Fluid**	**Extracellular fluid**	**Plasma**	**Intercellular fluid**
(a)	$^2/_3$ of total body water	$^1/_3$ of total body water	¼ of extracellular fluid	¾ extracellular fluid
(b)	$^1/_3$ of total body water	$^2/_3$ of total body water	¼ of extracellular fluid	¾ extracellular fluid
(c)	¼ of total body water	¼ of total body fluid	¼ of total body fluid	¼ of total body fluid
(d)	$^2/_3$ of total body water	$^1/_3$ of total body water	¾ of extracellular fluid	¼ of extracellular fluid

26. Which of the following comparisons of the autonomic and somatic divisions of the peripheral nervous system are incorrect?
    (a) Somatic division effects the skeletal muscle, autonomic effects the involuntary and cardiac muscle.
    (b) The efferent pathway of the autonomic division has a one neuron chain, whereas the somatic division has a two neuron chain.
    (c) Somatic division releases acetylcholine at its synapses and autonomic division releases norepinephrine, epinephrine and acetylcholine at its synapses.
    (d) Autonomic division's general function is homeostasis whereas the somatic division's function is to respond to the external environment.

27. Passive immunity can be obtained by:
    (a) by antibodies entering the blood stream across the placenta.
    (b) antigens being injected into the blood stream.

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(c) learning how to manufacture antibodies after being given a vaccination.
(d) by receiving a vaccination of dead microorganisms.

28. Antiviral drugs are now being manufactures to treat specific viral infections, antivirals work by:
    (a) destroying the protein coat surrounding the virus.
    (b) changing the structure of the cell membrane.
    (c) inhibiting the development of the virus.
    (d) killing the host cell.

29. Gas concentrations in the blood are constantly being monitored and controlled. Which of the following parts of the body are responsible for the control of gas levels in the blood.
    (a) Cerebellum and the medulla oblongata.
    (b) Medulla oblongata and the autonomic nervous system.
    (c) Cerebellum and the autonomic nervous system.
    (d) Hypothalamus and the medulla oblongata.

30. If you have a control group for your experiment, which of the following is true?
    (a) There can be more than one difference between the control group and experimental groups, but not several differences or else the experiment is invalid.
    (b) The control group must be half the size of the experimental group.
    (c) The control group and the experimental groups may have several differences between them.
    (d) The control group is identical to the experimental group except for the one variable that is being tested.

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

- This section has **eight (8)** questions. Answer **all** questions. Write your answers in the spaces provided.
- Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question(s) that you are continuing to answer at the top of the page.
- Suggested working time: 90 minutes.

- **Question 31** **(18 marks)**

- Ebola Virus Disease, EVD, is a complex zoonosis that is highly virulent in humans. It was first detected in 1976, with the largest ongoing outbreak being in West Africa. Development of a marketable vaccine has yet to be achieved, with VSV-EDOV still in phase III of development.

a) If Ebola is a zoonotic infection, how is it thought to be transmitted to humans? (1 mark)

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b) State three non-specific external defences that a human has and describe how they could prevent entry of the Ebola virus. (3 marks)

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c) Virus act in different ways to bacteria when they enter the human body. Explain how a pathogenic virus such as Ebola acts after entering the body to cause a disease. (3 marks)

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d) To diagnose a person with Ebola, an antigen-capture detection test can be used.

(i) What is an antigen? (1 mark)

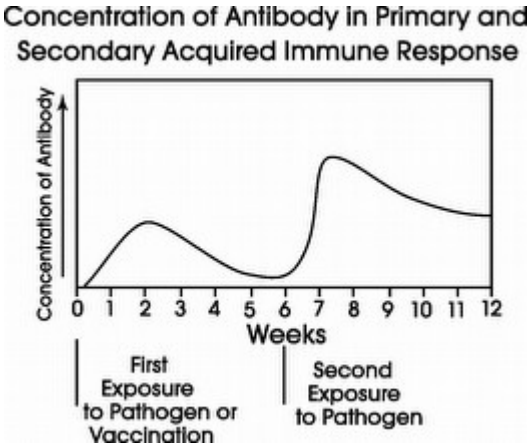
(ii) Explain why identifying the Ebola antigen could help the World Health Organisation develop a vaccine for Ebola. (1 mark)

e) In recent outbreaks of Ebola some people have survived an infection and made a full recovery. This has occurred because their body has learnt how to make the correct antibody against the virus.

(i) Describe three ways an antibody can work to provide resistance to infection. (3 marks)

(ii) Explain why a person who has recovered from Ebola can give blood to a person with Ebola and it may help them survive. (2 marks)

- The graph below shows how the body responds to two successive infections of a viral disease. Use this information to answer the next question.



- http://shawmst.org/biology/appendix/extended-responses/

f) Using the information in the graph, discuss why it is unlikely that a person that has had Ebola and has recovered is unlikely to get the disease again. (4 marks)

- **Question 32 (13 marks)**

- The standard treatment for hypothyroidism is daily use of synthetic thyroid hormone levothyroxine (T4). This medication restores adequate hormone levels for the individual to lead a normal life. One to two weeks after starting the treatment, symptoms should start to reduce. The medication gradually lowers bad-cholesterol levels (LDL – low density lipoproteins) and may reverse weight gain.

- Trials were carried out on 60 test subjects, all with similar levels of hypothyroidism, to see if there was any evidence that levothyroxine reduced LDL-cholesterol in the blood stream. 30 patients were given levothyroxine and the other 30 a placebo in a blind experiment. Patients were asked to take the drug daily for 8 weeks, at the end of each week their blood LDL-cholesterol levels were measured.

- Below are the average results for the two different groups:

• Number of weeks	• Average Blood cholesterol levels in mg/dL	
	• Patients taking levothyroxine	• Patients taking the placebo
• 0	• 190	• 191
• 1	• 190	• 191
• 2	• 189	• 190
• 3	• 180	• 187
• 4	• 173	• 189
• 5	• 171	• 179
• 6	• 168	• 188
• 7	• 153	• 189
• 8	• 147	• 187

a) Write a suitable hypothesis for this experiment. (1 mark)

b) State two variables that would need to be controlled that are not mentioned (2 marks)

c) What is a placebo? (1 mark)

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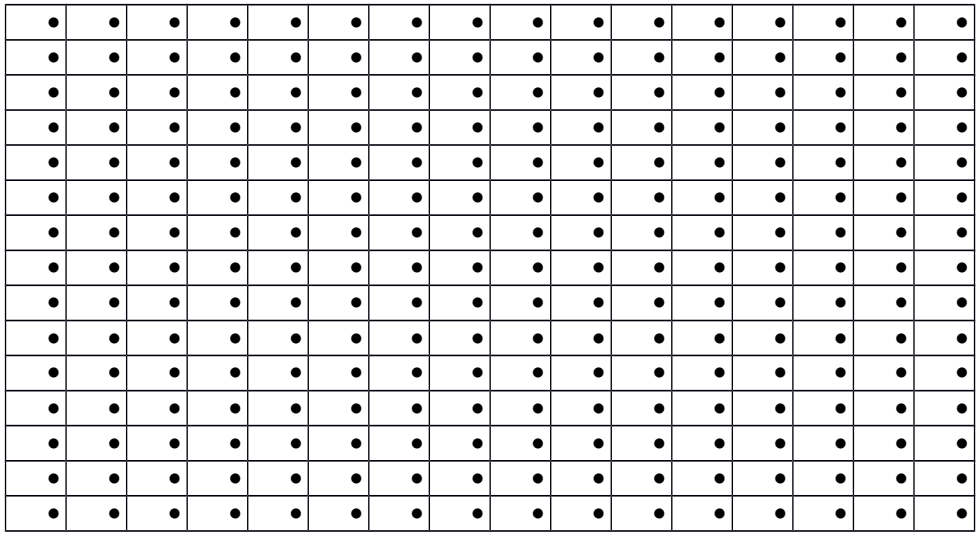
d) Plot a graph of the information contained in the table. (5 marks)



e) What conclusion can be drawn from the results? (2 marks)

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f) Is this conclusion valid? Explain your answer. (2 marks)

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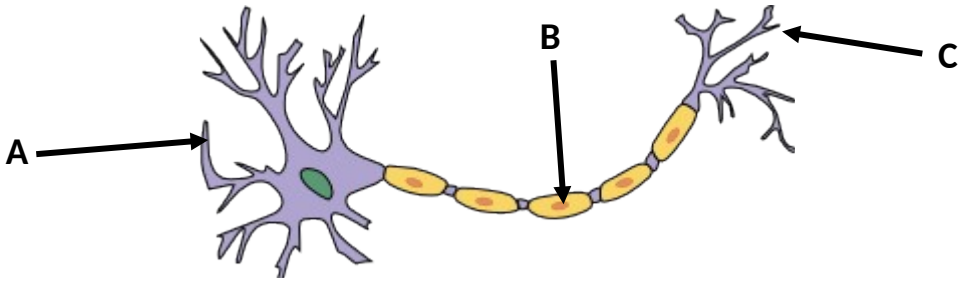
Question 33 (11 marks)

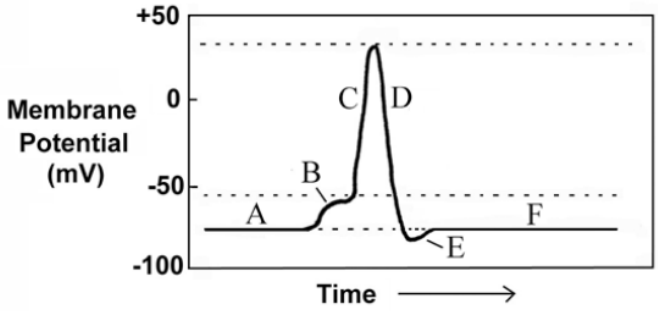
Below is a diagram of a neuron.



a) Describe the role of the structure labelled “A”. (1 mark)

b) What are the function of the cells labelled “B”? (1 mark)

- Use the graph below to answer the following questions.



c) Explain what is occurring at the phase indicated by the letter ”C” on the graph in terms of ion movement and membrane potential. (3 marks)

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d) Discuss the differences between how a nerve impulse is conducted along a myelinated and unmyelinated nerve fibre. (4 marks)

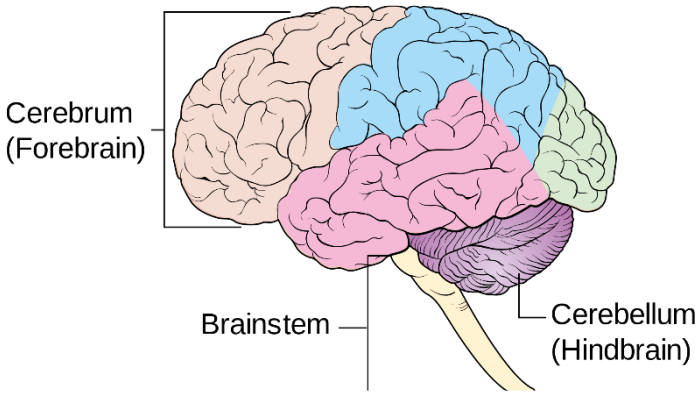
e) A nerve impulse is described as an all or nothing action. If this is correct, explain why a person can tell the difference between a lump of heavy metal being dropped on their foot and a loaf of bread. (2 marks)

Question 34 (13 marks)

a) The nervous system has several different systems which all have quite specific functions. Using the table below, state one comparison between the following nervous systems. (3 marks)

Two systems to compare	Main difference
Afferent division vs Efferent division of the peripheral nervous system	
Central nervous system compared to the peripheral nervous system	
Somatic sensory nervous system compared to the visceral sensory nervous system	

The diagram below is of the human brain.



b) On the diagram, label the following three areas: (2 marks)

(i) the occipital lobe.

(ii) the motor association area.

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c) The brain and the spinal cord are very delicate and as they are vital to human survival they must be protected. One structure that provides protection for these two parts is the meninges.

(i) Describe the structure of the meninges. (1 mark)

(ii) Explain the role of the cerebrospinal fluid within this structure. (2 marks)

d) The human brain is divided up into several sections, each with its own set of specific functions. Complete the table below by summarising the main function of each area shown. (3 marks)

Structure	Function
Cerebral Cortex	
Hypothalamus	
Cerebellum	

e) During a mining accident, a gentleman received substantial damage to his medulla oblongata when a metal pipe hit him from behind.

Describe one difficulty the man might experience as a result of this damage to the medulla oblongata and explain why. (2 marks)

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Question 35 (14 marks)

- Many retired soldiers have made the trip to Papua New Guinea to walk the Kokoda Track in memory of the Kokoda Trail campaign fought during World War II. The track is considered very difficult due to the extreme humidity and heat, but if people look after themselves properly during the trek, the track is manageable.

a) Describe two problems that extreme heat and humidity could cause for individuals walking the track. (2 marks)

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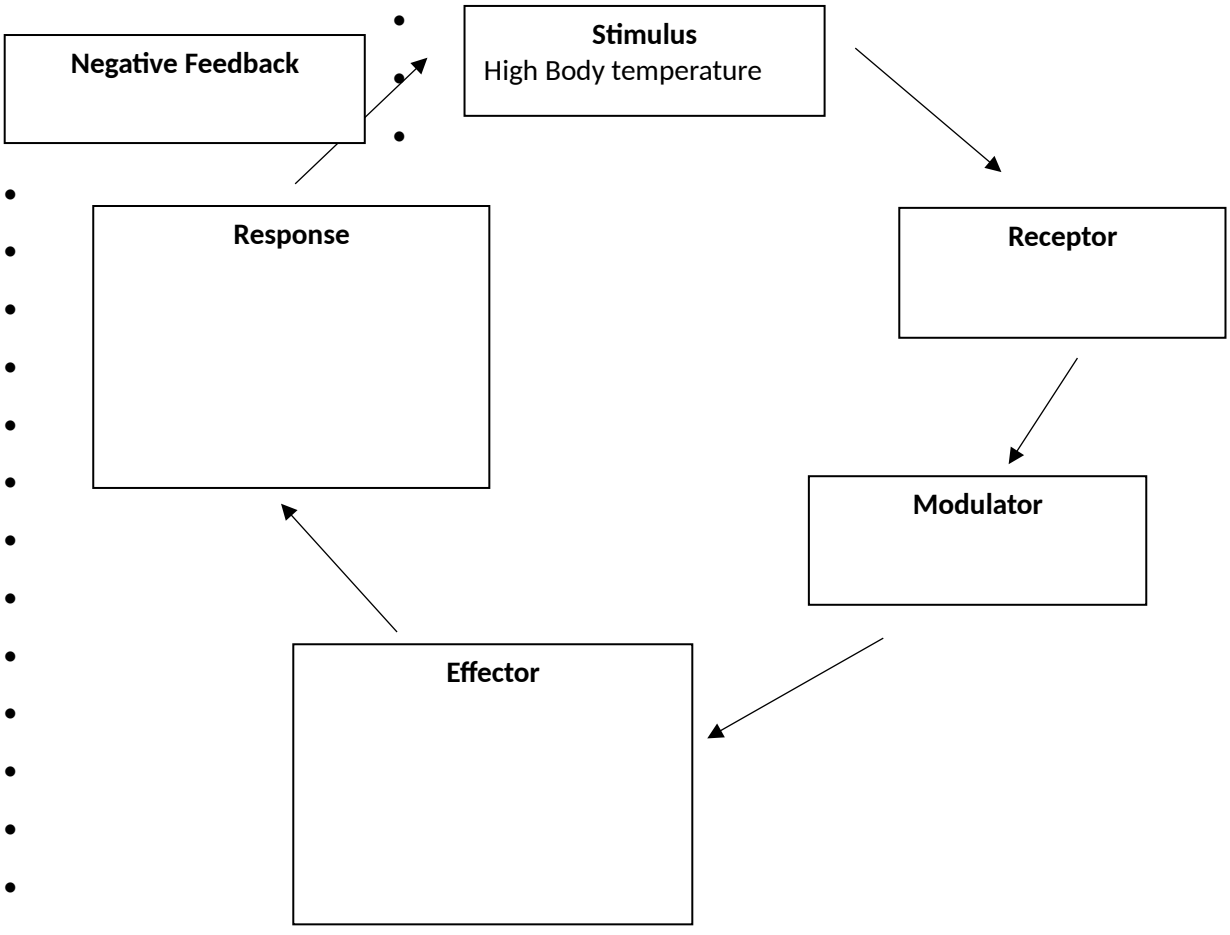
b) The control of the body's internal environment is essential is the person is going to be able to function properly and respond to the demands of such an arduous task of walking the track.

- Complete the feedback loop shown below to show how heat loss can be increased from the body to prevent overheating. Do not include the behavioural response. (5 marks)



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c) State a transmission method of heat loss that is being used by the body during the feedback loop described in part (b)? (1 mark)

d) The feedback loop is an effective mechanism for maintaining the body's core temperature. However the process of sweating initiated by the effector can cause other problems for the body.

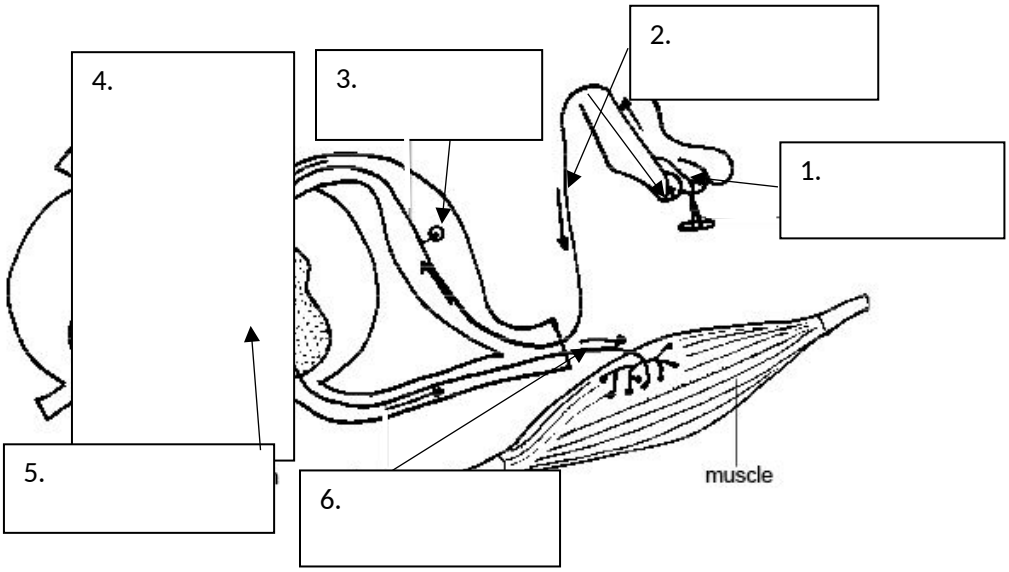
(i) Name one problem the processes brought about by the effector could produce? (1 mark)

(ii) Explain how the body would respond to try and combat the problem stated in part (i). (3 marks)

e) Explain the difference between a positive feedback loop and a negative feedback. (2 marks)

Question 36 (7 marks)

A reflex is a rapid response to a change in the internal and external environment.
The diagram below shows the main components of a reflex arc.



By By Ruth Lawson Otago Polytechnic - https://commons.wikimedia.org/w/index.php?curid=8831185

a) Identify the main components of the reflex arc indicated by the arrows on the diagram above. (3 marks)

b) Explain the difference between an innate reflex and an acquired reflex. (2 marks)

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c) A reflex is classed as part of a human's non-specific defence system. Explain the reasoning for this. (2 marks)

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- **Question 37 (11 marks)**

a) Pathogens are disease causing organisms. The most common types of pathogens are bacteria and viruses.

- If the pathogen was isolated what features would a scientist look for that could identify is the organisms was a virus or a bacteria? (2 marks)

b) Explain the role of the enzyme Lysozyme in the body's defence against disease. (1 mark)

c) During a game of soccer, one of the female players is pushed and falls to the ground, as she does, she cuts her knee open on a piece of old glass. By the time she reached home her knee had become all red and swollen. Her Mum told her not to worry about that because it was all part of her body's way of stopping the spread of pathogens that may have been on the glass. The girl's mother was talking about the inflammatory response.

- Explain, in sequence, the steps the body goes through during the inflammatory response.
(5 marks)

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d) During the night the girl developed a fever. The mother, thinking she was helping, gave the daughter some medication to bring her fever down.

Explain why this was not the right thing to do, as long as the fever is not extreme. (3 marks)

Question 38 (13 marks)

Type I diabetes affects around 120,000 Australians. It is caused when the body's own immune system attacks its own cells and prevents parts of the endocrine system from functioning normally.

a) Insulin is a protein based hormone. Explain how these types of hormones work. (2 marks)

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b) What type of cells produce insulin and where can they be found? (1 mark)

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c) Describe how insulin controls glucose levels in the body. (2 marks)

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d) The treatment for Type I diabetes is regular injections of insulin. Before the successful development of biotechnologies, this insulin was extracted from pigs and given to people suffering from Type I diabetes.

Discuss two ethical considerations that are associated with the extraction of insulin from pigs. (2 marks)

e) Now with the advances in biotechnologies most insulin is produced by recombinant DNA technology.

Explain how this process is much more beneficial to people suffering from Type I diabetes.

(2 marks)

f) One of the major concerns for a person suffering from Type I diabetes is becoming hyperglycaemic if they consume too much sugar.

(i) Describe two symptoms that a person would exhibit if they were hyperglycaemic? (2 marks)

(ii) Choose one of these symptoms and explain what has gone wrong in the body for this symptom to occur. (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.
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- 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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- **Question 39 (20 marks)**

- Nerve agents are often used as chemical weapons during times of war. Nerve agents work by preventing the production of acetylcholinesterase (AChE), a chemical that destroys acetylcholine after the nerve impulse has been transmitted. Nerve gas poisoning results in acetylcholine building up in the synaptic gap which drastically effects impulse transmission.

a) Explain how a nerve impulse is transmitted across a synaptic gap. (8 marks)

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b) Discuss how a nerve gas would affect the transmission the nerve impulses and the side effects a person would experience from nerve gas poisoning. (4 marks)

c) The sympathetic and parasympathetic nervous systems are both part of the bodies peripheral nervous system. Discuss the differences and similarities between the structure and function of the two systems. (8 marks)

- **Question 40 (20 Marks)**

Graves' disease is the result of a person's autoimmune system attacking the thyroid gland. As a result a person can suffer from hyperthyroidism, a condition that can be treated by removal of some of the thyroid.

a) The common symptoms of hyperthyroidism are weight loss, increased appetite, fatigue, sweating and anxiety. Using your understanding of the functioning of the thyroid gland, explain how these symptoms are brought about. (8 marks)

b) A rapid heart rate is also a symptom of hyperthyroidism and this can subsequently lead to an increase in blood pressure. Normally these two factors are controlled by negative feedback systems.

- Describe how the body would normally bring the heart rate and blood pressure back to normal and explain how hyperthyroidism affects these systems. (12 marks)

- **Question 41 (20 marks)**

The World Health Organisation are currently working on trying to eliminate polio by using a range of vaccination programs. Vaccinations are used to develop immunity in a population.

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However traditional vaccines can come with associated risks and ethical concerns so more modern techniques are being tested to come up with vaccines that are more effective and have less associated risks

- a) Describe two traditional types and one modern type of vaccine, and discuss the risks and ethical concerns that are associated with vaccines.
  (12 marks)

- b) Viruses such as polio when they enter the body can cause both a humoral and cell-mediated response. Describe the steps that occur during a cell-mediated immune response, including how the response was instigated and carried out. (8 marks)

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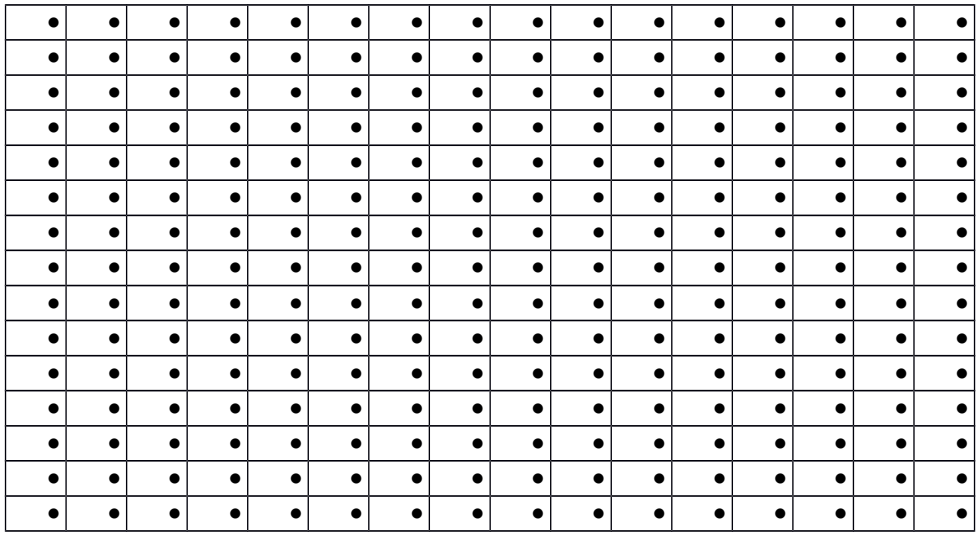
Spare graph for question 32



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- Multichoice question 4
- Picture of neurons from - https://learnzoology.wordpress.com/2013/10/29/nervous-tissue/
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- Question 31f
- Graph of primary and secondary infection - http://shawmst.org/biology/appendix/extended-responses/
-
- Question 33
- Diagram of neuron – http://www.clker.com/clipart-neuron.html
- Diagram of nerve impulse - http://biology.stackexchange.com/questions/14618/refractory-period-in-action-potential
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- Question 34
- diagram of brain - http://www.clker.com/clipart-brain-clipart-without-eye.html
-
- Question 36
- reflex diagram - By By Ruth Lawson Otago Polytechnic - originally uploaded at en.wikibooks. original description page is/was here[1], CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=8831185
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