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**HUMAN BIOLOGY**

**Unit 3**

**2021**

**Insert School Logo**

**Mark Key**

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 (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: non-programmable calculators approved for use in this examination

**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 material. 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 examination |
| Section One  Multiple-choice | | 30 | 30 | 40 | 30 | 30 |
| Section Two  Short answers | | 9 | 9 | 90 | 100 | 50 |
| Section Three:  Extended answers | 40-41 | 2 | 1 | 50 | 40 | 20 |
| 42-43 | 2 | 1 |
|  | |  |  |  | **Total** | 100 |

**Instructions to candidates**

1. The rules for the conduct of the Western Australian examinations are detailed in the *Year 12 Information Handbook 2021*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.

3. 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. Do not use erasable or gel pens. 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.

Section Two: Write your answers in this Question/Answer booklet. Wherever possible, confine your answers to the line spaces provided.

Section Three: Consists of four questions. You must answer two questions. Tick the box next to the question you are answering. Write your answers in this Question/Answer booklet.

4. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.

5. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

**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. Do not use erasable or gel pens. 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: 40 minutes.

|  |  |
| --- | --- |
| Question | Answer |
| 1 | B |
| 2 | B |
| 3 | C |
| 4 | B |
| 5 | C |
| 6 | B |
| 7 | A |
| 8 | D |
| 9 | D |
| 10 | B |
| 11 | C |
| 12 | A |
| 13 | A |
| 14 | A |
| 15 | D |
| 16 | D |
| 17 | D |
| 18 | B |
| 19 | A |
| 20 | D |
| 21 | C |
| 22 | C |
| 23 | A |
| 24 | A |
| 25 | D |
| 26 | C |
| 27 | B |
| 28 | B |
| 29 | B |
| 30 | D |

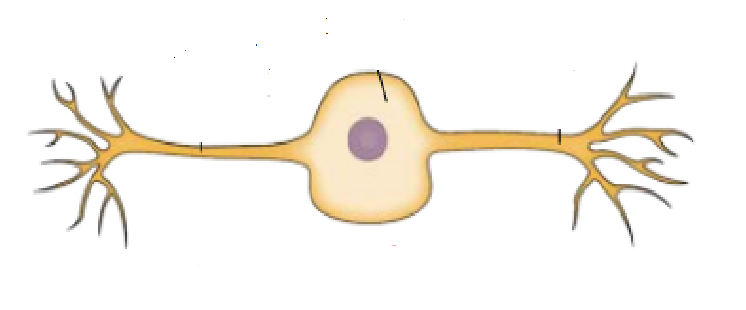
1. Which of the following lists contains only bacterial pathogens?
   1. tuberculosis, influenza, tapeworm
   2. syphilis, tuberculosis, tetanus
   3. tapeworm, tetanus, syphilis
   4. influenza, syphilis, tetanus
2. Homeostatic control of body temperature is coordinated by which part of the brain?
   1. medulla oblongata
   2. hypothalamus
   3. cerebellum
   4. cerebral cortex
3. The function of the interneurons is to
   1. carry sensory information to the brain.
   2. conduct nerve impulses down the spinal cord to lower motor neurons.
   3. transmit information between the afferent and efferent neurons.
   4. carry sensory information away from the brain.
4. Which of the following is a correct comparison of the nervous and endocrine systems?
   1. hormones have a rapid action, nerve impulses are slower
   2. hormones act on any cells that have receptors for that hormone, nerve impulses act on specific cells only
   3. hormones act on the body for a short period of time, nerve impulses act for much longer
   4. hormones are electro-chemical messages and nerve impulses are chemical messages

Questions 5 and 6 refer to the table below.

A year 12 Human Biology student measured the resting pulse rate of four of her classmates.

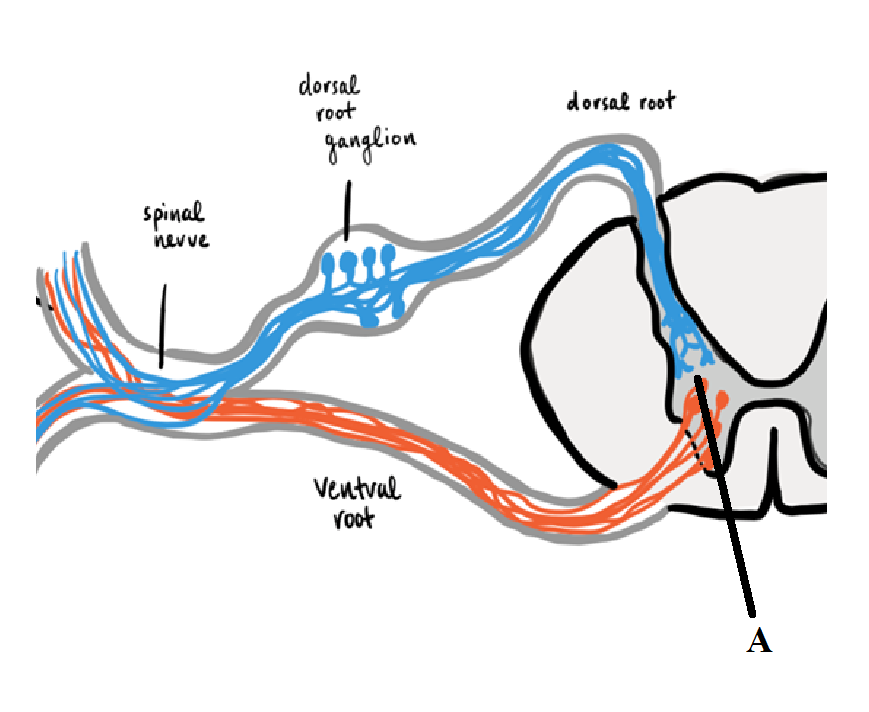
|  |  |
| --- | --- |
| Student | Pulse rate  (beats/min) |
| 1 | 65 |
| 2 | 90 |
| 3 | 58 |
| 4 | 65 |

1. What would the mode be for this set of data?
   1. 90
   2. 32
   3. 65
   4. 70
2. Which students’ resting heart rate could be considered an outlier?
   1. Student 1
   2. Student 2
   3. Student 3
   4. Student 4
3. The receptors that detect CO2 levels in the blood are
   1. chemoreceptors.
   2. thermoreceptors.
   3. baroreceptors.
   4. photoreceptors.
4. The target organ for the hormone Anti-Diuretic Hormone (ADH) is the
   1. liver.
   2. bones.
   3. bladder.
   4. kidney.
5. A person who has blood sugar levels below 4.0mmol/L (90mg/100mL) is experiencing
   1. type I diabetes.
   2. type II diabetes.
   3. hyperglycaemia.
   4. hypoglycaemia.
6. Which of the following would be a **correct** definition of positive feedback?
   1. when the body returns to normal
   2. when the original stimulus is intensified
   3. when the original stimulus is reversed
   4. when the original stimulus cannot be reversed



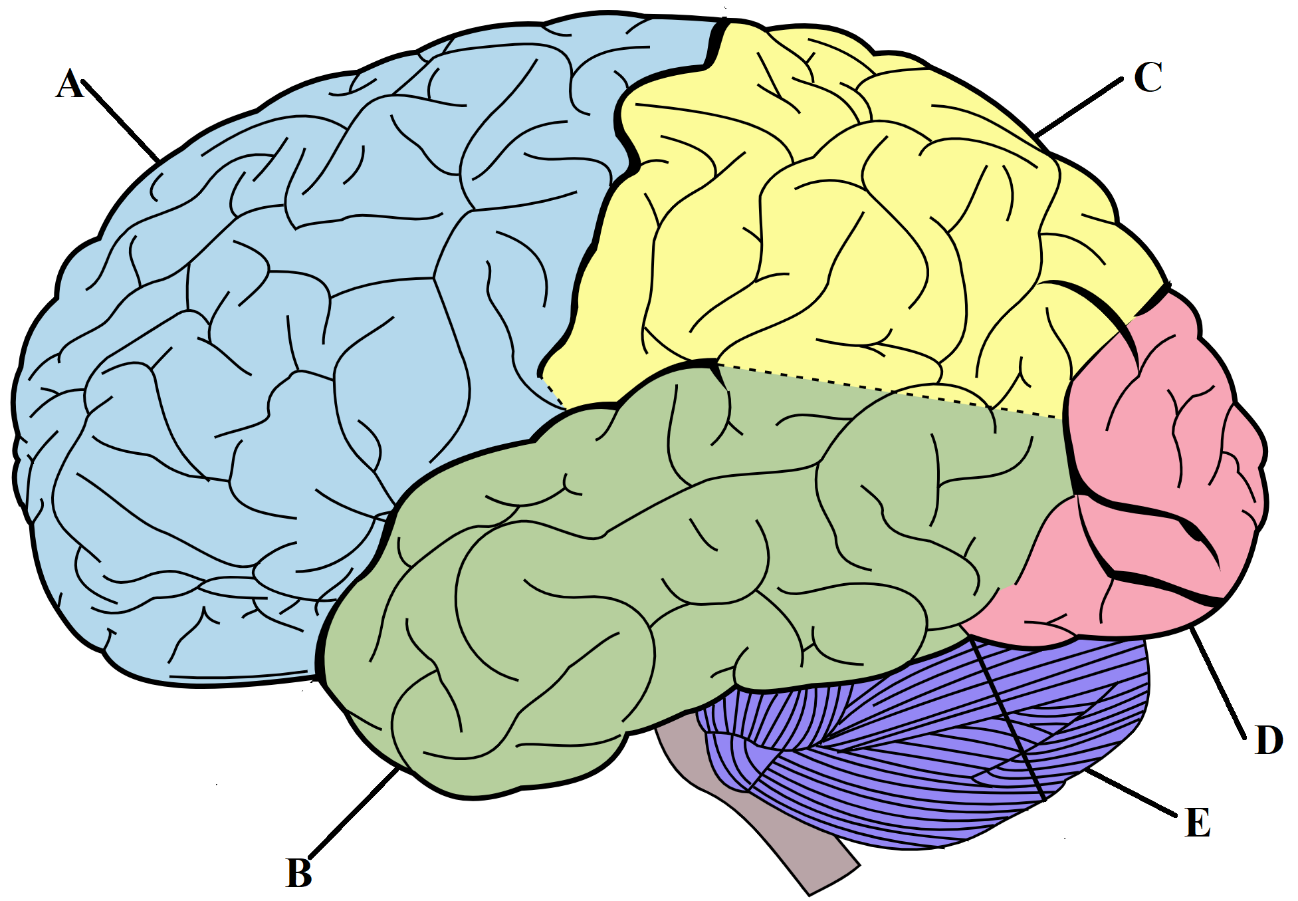
1. The neuron shown in the diagram above is
   1. a receptor.
   2. unipolar.
   3. bipolar.
   4. multipolar.
2. Which of the following is **NOT** a response that occurs following parasympathetic stimulation?
   1. decreased sweat production
   2. increased urine production
   3. decreased heart rate
   4. increase saliva production

Question 13-15 refers to the diagram below.



1. Which of the following would be found in the dorsal root ganglion?
   1. sensory neuron cell bodies
   2. motor neuron cell bodies
   3. sensory nerves
   4. mixed nerves
2. What type of neurons would be found at the point labelled A?
   1. interneurons
   2. unipolar neurons
   3. multipolar neurons
   4. pyramidal cells
3. What would be the effect on a person if the ventral root was severed completely?
   1. no effect
   2. they wouldn’t be able to feel stimuli or move the part of the body corresponding to the nerve
   3. they wouldn’t be able to feel stimuli corresponding to the nerve
   4. they wouldn’t be able to move the part of the body corresponding to the nerve
4. Which of the following is **NOT** a function of the myelin sheath?
   1. speeds up nervous transmission
   2. insulates the axon
   3. protects the axon
   4. reduces threshold by 5mV
5. In which circumstance would memory cells be produced?
   1. getting a deep cut
   2. a baby receives immunoglobulins in breast milk from its mother
   3. a person receives rabies antibodies after being bitten by a stray dog while on holiday
   4. a person contracts measles and becomes ill
6. What type of vaccine is made up of the living pathogen that has been altered to render it non-virulent?
   1. toxoid
   2. attenuated
   3. sub-unit
   4. conjugate
7. Which of the following pairings is **correct**?
   1. endocrine gland: ovary; hormone: oestrogen
   2. endocrine gland: pancreas; hormone: cortisol
   3. endocrine gland: parathyroid: hormone: calcitonin
   4. endocrine gland: pineal gland; hormone: thyroid stimulating hormone
8. Which is the **best** definition of a suppressor T-cell?
   1. a type of cell that secretes antibodies
   2. a type of cells that kills foreign cells, cancer cells and cells infected with viruses
   3. a type of cell that stimulates the action of some lymphocytes
   4. a type of cell that blocks the action of some lymphocytes to prevent the immune system from becoming over-active
9. Which of the following is a correct comparison between B-cells and T-cells?
   1. B-cells and T-cells both travel in the blood
   2. B-cells and T-cells both stay in the lymph nodes
   3. B-cells stay in the lymph nodes and T-cells travel in the blood
   4. T-cells stay in the lymph nodes and B-cells travel in the blood

Use the diagram below to answer questions 22-24



1. Which label shows the parietal lobe?
   1. A
   2. B
   3. C
   4. D
2. What is the function of E?
   1. to coordinate motor functions
   2. transfers information between the left and right hemispheres
   3. controls body temperature
   4. regulate thirst and hunger impulses
3. What could result from damage to D?
   1. disturbances of vision
   2. inability to initiate voluntary movement
   3. loss of hearing
   4. sensitivity to temperature changes
4. The part of the brain most associated with the regulation of thirst?
   1. medulla oblongata
   2. cerebrum
   3. cerebellum
   4. hypothalamus
5. Which is the best definition of “accuracy” according to the scientific method?
   1. baseline data to compare experiment results to
   2. the extent to which an experiment produces consistent results
   3. the extent to which a concept is correctly and precisely measured
   4. the extent to which the hypothesis is tested by the method
6. How do bacteriostatic antibiotics act on bacteria?
   1. they kill the bacteria
   2. they slow bacterial growth or reproduction
   3. they inhibit cell wall synthesis
   4. they dehydrate the bacteria
7. What is the refractory period in an action potential?
   1. the time it takes for threshold to be reached
   2. the time following stimulation where the neuron cannot be stimulated again
   3. the time it takes for the action potential to pass through the axon
   4. the period where the membrane charges switch
8. Which of the following comparisons describing the differences between the anterior and posterior pituitary is **correct?**

|  |  |  |
| --- | --- | --- |
|  | **Anterior Pituitary** | **Posterior Pituitary** |
| (a) | Produces oxytocin | Produces Follicle Stimulating Hormone (FSH) |
| (b) | Connects to the hypothalamus via capillaries | Connects to the hypothalamus via nerve axons |
| (c) | Releases hormones only | Produces and releases hormones |
| (d) | Released fewer hormones than posterior pituitary | Releases more hormones that anterior pituitary |

1. A researcher was testing the hypothesis:

**“A low-sodium diet reduces blood pressure in people over 50 years old”**

The independent variable in this experiment was the:

* 1. age of the subjects.
  2. total kilojoule consumed daily.
  3. blood pressure.
  4. low-sodium diet.

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

This section has **nine** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

**Question 31 (18 marks)**

Alzheimer’s disease is a degenerative neurological disease that causes a loss of memory and thinking skills in sufferers. There is currently no effective treatment for this disorder though clinical trials are being conducted using cell-replacement therapy.

One such clinical trial conducted previously transplanted stem-cells into parts of the brains of Alzheimer’s patients that were damaged by the disease. Before this treatment occured a large amount of cognitive reasoning and memory tests were given to establish a baseline level of damage. These tests were then conducted on the patient post-surgery every month to monitor progress.

1. Propose an appropriate hypothesis for this investigation. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| A statement linking the independent variable to the dependent variable | 1 |
| E.g.: The cognitive reasoning/memory of the Alzheimer’s sufferer improves after the cell replacement therapy. |  |
| **Total** | **1** |

1. Name the independent and dependent variables in this experiment. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Independent Variable: Cell-Replacement therapy | 1 |
| Dependent: Cognitive Reasoning and Memory | 1 |
| **Total** | **2** |

1. Define the term ‘control group’ and suggest a reason why a control group was not used in this study.

(2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Control Group: The standard to which comparisons are made in an experiment | 1 |
| Could compare the cognitive reasoning and memory after the operation to before the operation/ not ethical to put elderly people through the stress of a major operation for no reason | 1 |
| **Total** | **2** |

1. State **three** variables that would need to be controlled to ensure a fair test.

(3 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| **Any three of the following** | |
| All patients have Alzheimer’s | 1-3 |
| Same method to transplant Stem-Cells |
| Same method to measure cognitive reasoning and memory |
| Same frequency to measure cognitive reasoning and cognitive capacity |
| **Total** | **3** |

The score for the memory tests and cognitive reasoning tests were aggregated into a percentage.

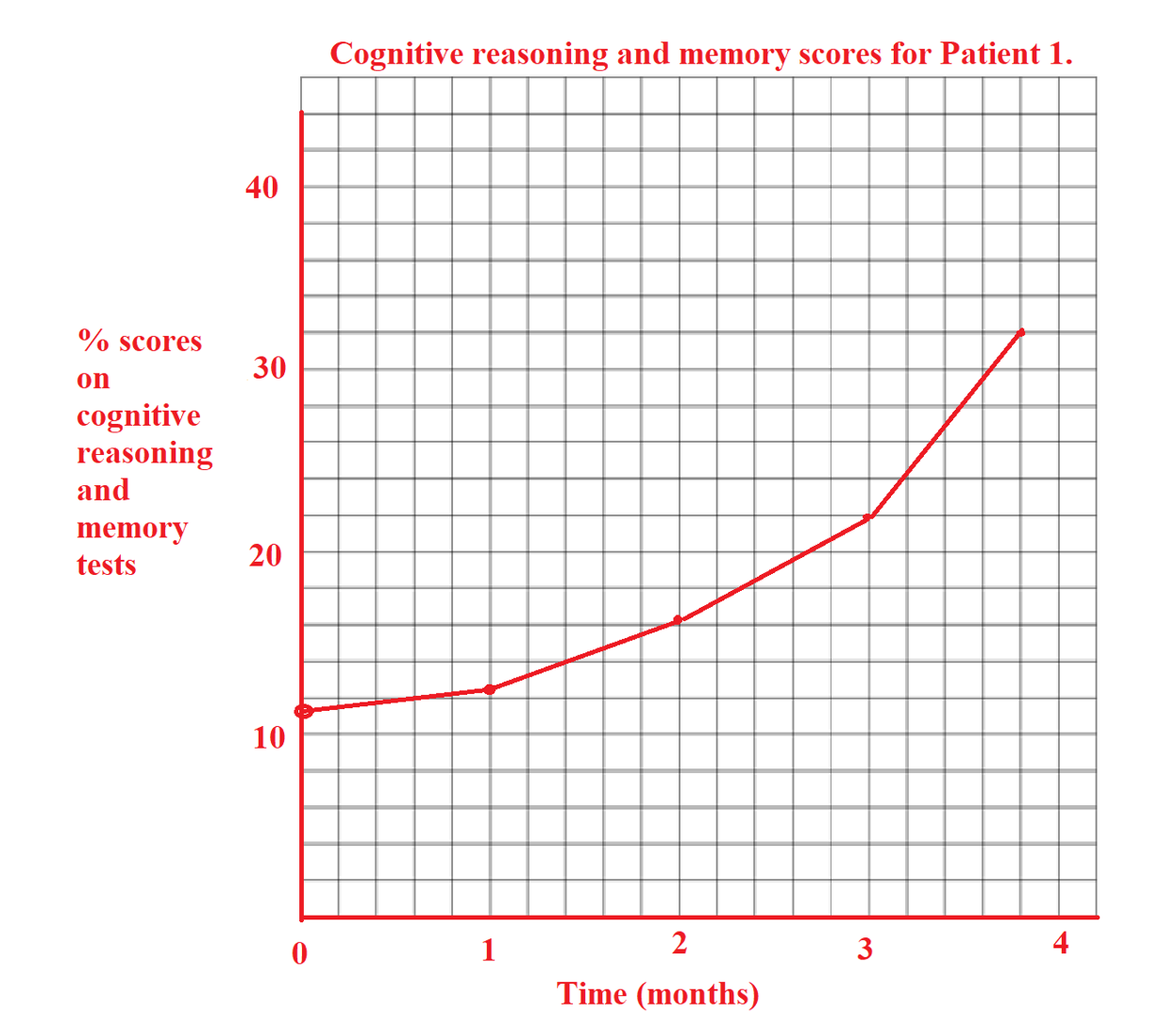
|  |  |  |  |
| --- | --- | --- | --- |
|  | **Patient 1 (%)** | **Patient 2**  **(%)** | **Patient 3**  **(%)** |
| Before surgery | 12 | 15 | 17 |
| 1-month post-surgery | 13 | 14 | 17 |
| 2-month post-surgery | 17 | 19 | 20 |
| 3-month post-surgery | 22 | 25 | 25 |
| 4-month post-surgery | 32 | 29 | 28 |

1. Calculate the mean test score for the three patients at 4-months post-surgery.

(1 mark)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| 29.7% | 1 |
| **Total** | **1** |

1. Use the grid below to construct a line graph for patient 1. (5 mark)



|  |  |
| --- | --- |
| **Description** | **Mark** |
| Correctly constructs axes using appropriate scales. | 1 |
| Correct plots points using a line graph with points joined | 1 |
| Labelling of axes with correct name and unit | 1 |
| Identifies conditions using keys/labels | 1 |
| Title appropriate with both independent and dependent variables included | 1 |
| **Total** | **5** |

1. Using your knowledge of cell-replacement therapy, suggest why improvement following this procedure has been so slow. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Stem cells would take time to (differentiate) into nerve cells | 1 |
| Nerve cells would take time to begin to function properly | 1 |
| **Total** | **2** |

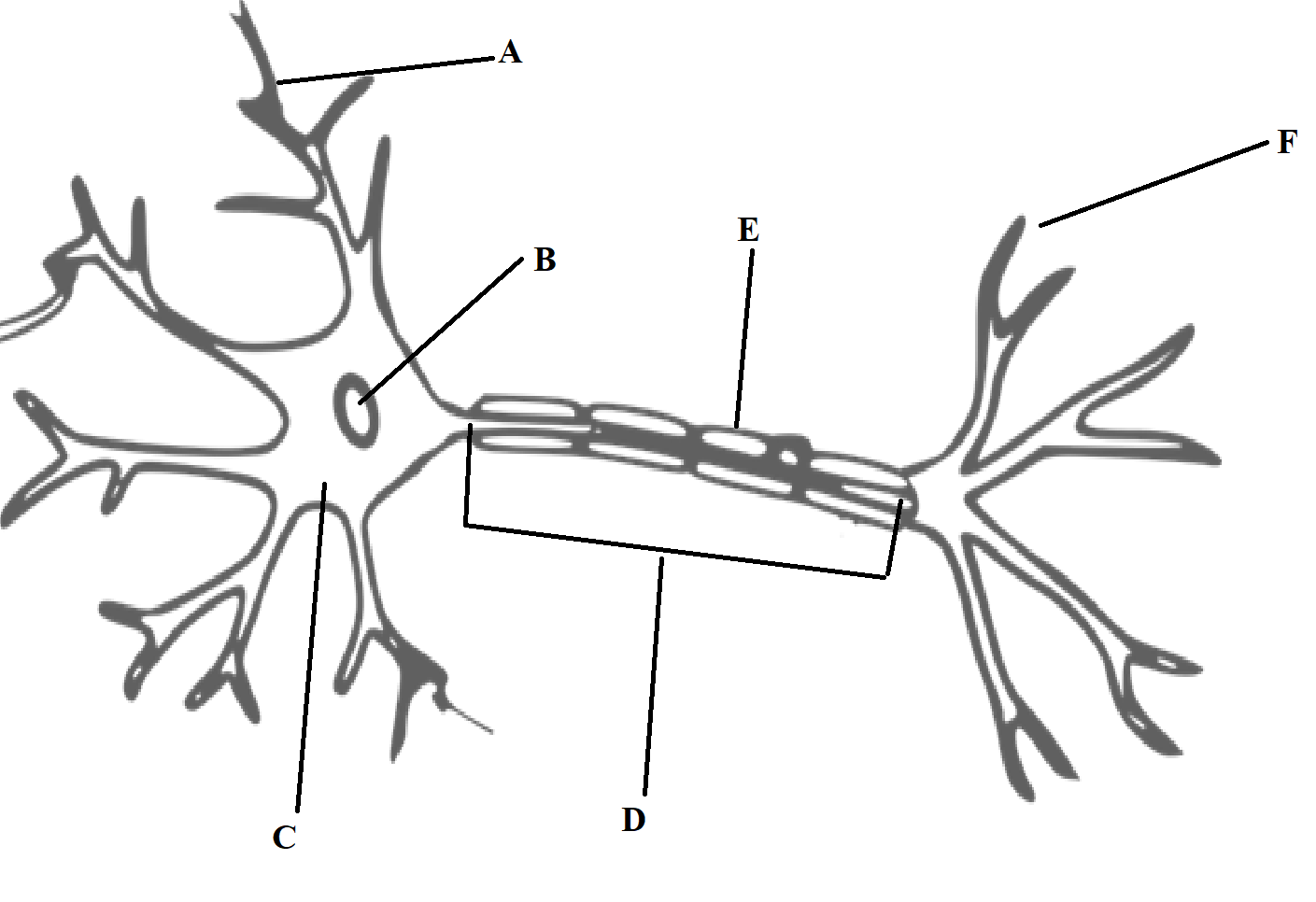
1. State a suitable conclusion that could be made based on the results of this study*.*

(2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Cell-replacement therapy causes an increase | 1 |
| In cognitive reasoning and memory in Alzheimer’s sufferers | 1 |
| **Total** | **2** |

**Question 32 (9 marks)**

Use the diagram below to answer the following questions.



1. Name the following structures. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| A: Dendrite | 1 |
| B: Nucleus | 1 |
| **Total** | **2** |

1. Describe the function of the following structures. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| C: supports the internal structure/maintains shape/consistency | 1 |
| C: site of energy production/storage/ manufacture of cellular components | 1 |
| D: site of action potential/nerve transmission | 1 |
| D: carries the impulse away from the cell body | 1 |
| **Total** | **4** |

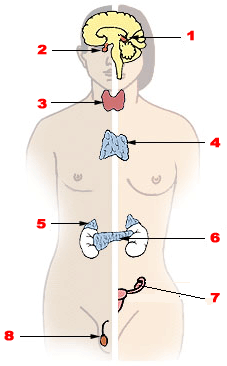
1. Describe the process that results in neurotransmitters being released from part F.

(3 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Depolarisation of the membrane of the axon terminal/ action potential occurs | 1 |
| Ca2+ enters cell/ docking proteins drag vesicles containing neurotransmitters to membrane | 1 |
| Vesicles containing neurotransmitters bind to membrane releasing contents into synapse | 1 |
| **Total** | **3** |

**Question 33 (15 marks)**

The diagram below shows the glands of the endocrine system.



1. Name the endocrine organs numbered below and for each one, give an example of **one** hormone it releases. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| 2: Pituitary Gland | 1 |
| 2: FSH/Oxytocin/Prolactin/GH/ACTH/TSH/LH/ADH/MSH | 1 |
| 3: Thyroid | 1 |
| 3: Thyroxine/ Calcitonin | 1 |
| 4: Thymus | 1 |
| 4: Thymosin | 1 |
| **Total** | **6** |

1. Complete the table below to identify the **target organ/s** and the **effect on the body** of the following hormones. (6 marks)

|  |  |  |
| --- | --- | --- |
| **Hormone** | **Target organ/s** | **Effect on the Body** |
| **Testosterone** | * Many cells in the body | * Develops secondary sexual characteristics * Maintains sperm production * Increases muscle growth   (any one) |
| **Oxytocin** | * Uterus * Mammary glands   (any one) | * Triggers uterine contractions during labour * Stimulates milk letdown   (any one [effect must match target organ]) |
| **Growth Hormone** | * All/most body cells | * Growth and development |

1. Describe **one** effect on the body for the overproduction of each of the following hormones. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Thyroxine: Hyperthyroidism/Graves disease/ fast metabolism/fast or irregular heartbeat/weight loss (accept any correct symptom) | 1 |
| Oestrogen: Bloating/swollen breast tissue/ fibrocystic lumps in breasts/ decreased sex drive/ irregular periods/ mood swings/ headaches/ weight gain (accept any correct symptom) | 1 |
| Aldosterone: High blood pressure/ muscle aches/ muscle spasms/ weakness/ paralysis (accept any correct symptom) | 1 |
| **Total** | **3** |

**Question 34 (5 marks)**

Addison’s disease is an endocrine disorder where sufferers fail to produce enough of the hormone cortisol.

1. Name theorgan of the endocrine system that would be affected by Addison’s disease.

(1 mark)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Adrenal cortex | 1 |
| **Total** | **1** |

1. Describe the role of Adrenocorticotrophic Hormone (ACTH) on maintaining normal cortisol levels in the blood. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Anterior pituitary detects low levels of cortisol in the blood | 1 |
| ACTH is produced by the anterior pituitary | 1 |
| ACTH travels in the blood stream and attaches to the receptors on the adrenal cortex | 1 |
| Adrenal cortex produces cortisol | 1 |
| **Total** | **4** |

**Question 35 (12 marks)**

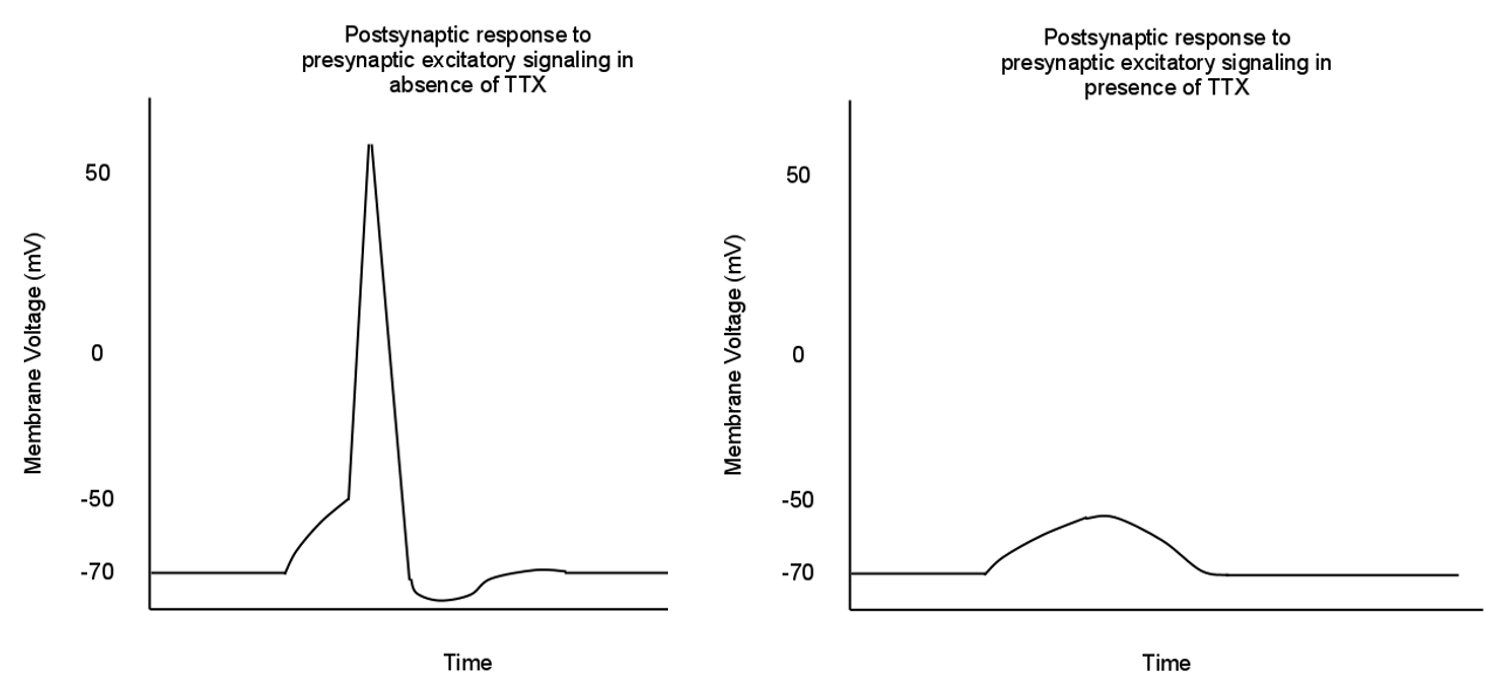
Fugu is a Japanese dish that is made from the pufferfish. While this dish is very sought after it needs to be prepared carefully as large parts of the pufferfish contain a neurotoxin called Tetrodotoxin (TTX). If TTX is ingested, it binds to Sodium ion (Na+) channels in the neuron, preventing them from transporting Na+ across the membrane, causing the cells to fail to reach threshold and signal an action potential. People then experience paralysis and cardiac arrest.

1. What does the term threshold mean in terms of an action potential? Explain how this threshold is reached. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Threshold: The membrane voltage in a neuron that must be reached during depolarisation to trigger an action potential | 1 |
| Stimulation of the dendrites causes Na+ channels (in the cell membrane) to open | 1 |
| The open protein channels cause more Na+ ions to move into the cell | 1 |
| Na+ ions cause the electrical potential of the cell membrane to rise | 1 |
| Until it reaches 15mV higher, triggering an action potential | 1 |
| **Total** | **4** |

1. Information is passed from the pre-synaptic neuron to the dendrites using neurotransmitters. Explain how neurotransmitters transmit the impulse across a synapse. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Neurotransmitter vesicles attach to the axon terminal membrane | 1 |
| Voltage gated Ca2+ channels open, and Ca2+ released into synapse | 1 |
| Ca2+ causes neurotransmitter vesicles to release their contents | 1 |
| Neurotransmitters are released into the synapse | 1 |
| Neurotransmitters migrate across the synapse via diffusion | 1 |
| Neurotransmitters bind to receptors on the post-synaptic cleft (to carry on the message) | 1 |
| This causes Na+ channels to open - depolarisation of dendrites. | 1 |
| Impulse continues along neurone. | 1 |
| **(Any 3 points above to form a coherent ordered explanation.)** | **Max 3** |

Use the diagram below to answer questions 35 c

1. TTX affects the neurons by stopping Na+ from entering the cell. Referring to the diagram above, explain why neurotransmission fails. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Electrical potential across the membrane won’t change | 1 |
| Threshold won’t be reached/ Action potential won’t be triggered | 1 |
| **Total** | **2** |

1. There is no antidote for TTX but people who have ingested it are sometimes given Atropine which is a drug that can stimulate the sympathetic nervous system to try and counter the effects of TTX. What are three changes that could occur in someone who has been treated with Atropine? (3 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Any three | |
| Increased heart rate | 1-3 |
| Increase blood pressure |
| Production of saliva |
| Dilation of pupils |
| Inhibition of digestive activity |
| Increased adrenaline/noradrenaline production |
| **Total** | **3** |

**Question 36 (8 marks)**

*Herpes simplex labialis* is a pathogen that causes recurrent outbreaks of cold-sores to those that are infected with this virus. It is estimated that between 50%-80% of humans have this virus.

1. *Herpes simplex labialis* is a virus. List three structural characteristics of a virus. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| A genome made of single stranded DNA or RNA | 1 |
| A protein cap/capsid that covers the genome | 1 |
| A lipid envelope | 1 |
| **Total** | **3** |

1. *Herpes* can be spread from those infected to those who are not infected by contact with the saliva or fluids from the blister when the sufferer is having an outbreak. Outline three steps that a person with an active cold-sore could take to avoid passing on the Herpes virus to the non-infected. (3 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Any three | |
| Avoid close physical contact/ kissing | 1-3 |
| Avoid touching the cold sore |
| Wash hands regularly |
| Not sharing cutlery/crockery/cosmetics |
| **Total** | **3** |

1. Cold-sore outbreaks due to *Herpes* can be treated with topical antiviral medication. State how these antiviral medicines work to suppress the viral outbreak.

(2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Stop the virus from reproducing | 1 |
| Stop the virus from entering uninfected cells | 1 |
| **Total** | **2** |

**Question 37 (10 marks)**

Allie was daydreaming about what she would have for dinner and accidently walked in front of a truck. She looked up just in time to jump out of the way of the truck before being hit.

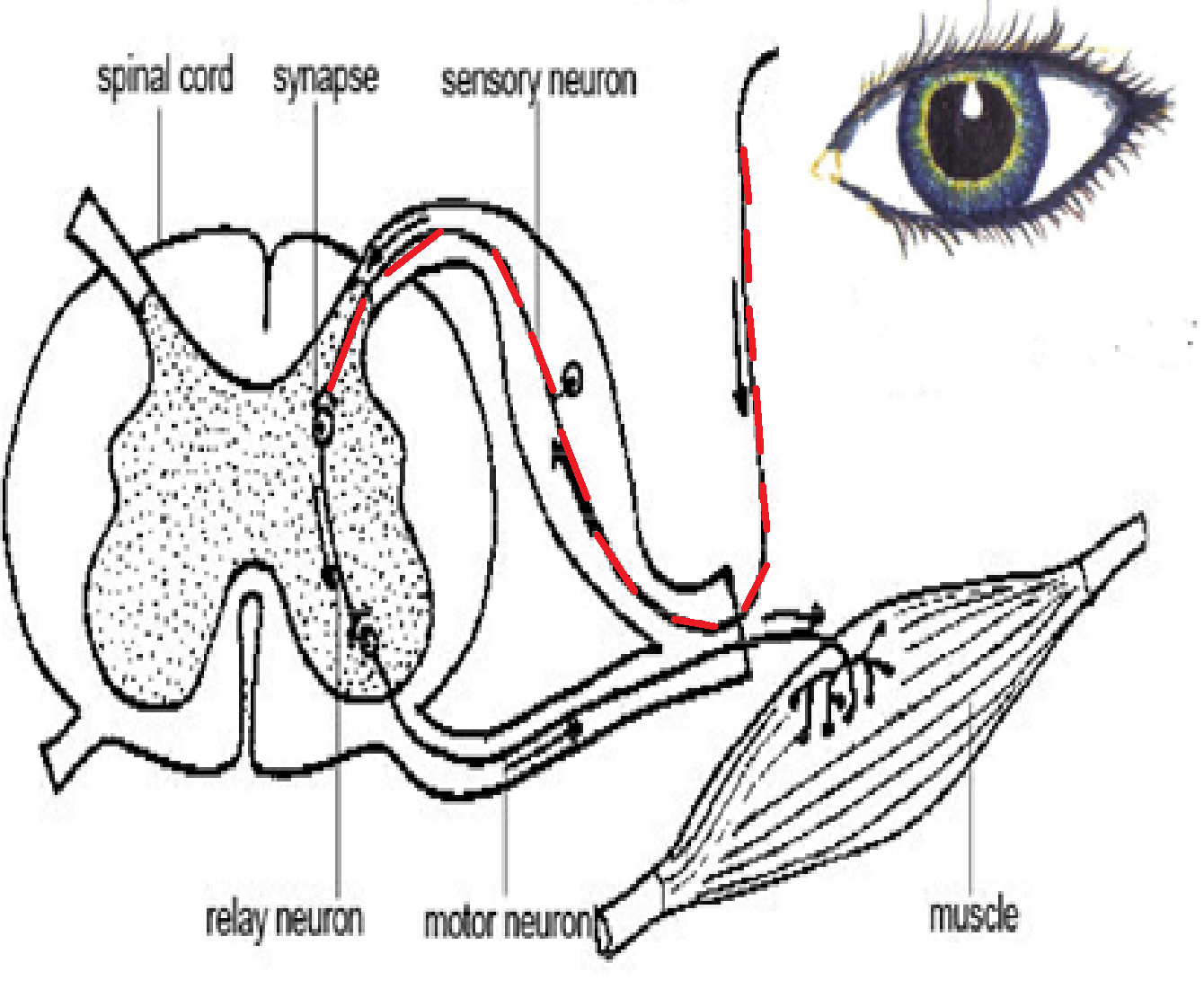
1. The photoreceptors in her eyes allowed Allie to see the truck. Name the receptor that Allie used to feel the heat of the exhaust as the truck drove past. (1 mark)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Thermoreceptor | 1 |
| **Total** | **1** |

1. Explain how the heat of the truck was processed through this receptor to be recognised by Allie’s Central Nervous System. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Receptor in the skin detects heat | 1 |
| Heat is converted into electrical signals | 1 |
| Sensory neurons transmit signals to cerebrum/cerebral cortex/parietal lobe | 1 |
| Sensation is interpreted by the cerebrum/CNS/occipital lobe/parietal cortex | 1 |
| **Total** | **4** |

Question 37 (c-d) refers to the diagram of the reflex arc below.



1. When Allie responded to the truck, she blinked without being consciously aware of it. Outline how this was possible. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Reflex arc would send the stimuli to the spinal cord | 1 |
| Spinal cord would signal a response before the brain recognises the stimuli | 1 |
| **Total** | **2** |

1. On the diagram highlight the afferent pathway of the reflex arc.

(1 mark)

1. Sufferers of Motor Neuron Disease have a breakdown of structure and function of the motor neuron. If Allie had been suffering from this condition, describe how the reflex arc would have been different when she saw the truck.

(2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| The message would have been sent to the motor neurons to move out of the way | 1 |
| Because of the damage to the motor neurons no movement would have occurred | 1 |
| **Total** | **2** |

**Question 38 (9 marks)**

Homeostasis is the maintenance of internal body conditions within tolerance limits. It involves behavioural and physiological activities.

1. Describe **two** physiological responses to increased levels of blood sugar in the body. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Release of insulin from the pancreas to the blood stream from Beta cells | 1-2 |
| Conversion of glucose to glycogen/glycogenesis |
| Increased uptake of glucose by the cells |
| Release of Thyroxine/Triodothyronine/T3 from thyroid gland to blood  Increases respiratory rate | 1-2 |
| Release of cortisol from adrenal cortex to blood  Increases respiratory rate | 1-2 |
| Release of adrenaline from adrenal cortex to blood  Increases respiratory rate | 1-2 |
| Release of adrenaline from adrenal cortex to blood  Increases respiratory rate | 1-2 |
| Release of (testosterone/oestrogen/progesterone) from (testes/ovary/ovary) to blood  Increases respiratory rate | 1-2 |
| **Total** | **2** |

1. Describe **two** behavioural responses to a decrease in body temperature. (2 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| **Any two (accept other correct answers)** | |
| Increase amount of clothing | 1-2 |
| Turn on a heater/sit near a fire |
| Increase physical activity |
| **Total** | **2** |

1. Temperature regulation and blood sugar regulation are controlled by negative feedback. What does this mean? (1 mark)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| That the response reverses/or reduces the initial stimulus | 1 |
| **Total** | **1** |

1. Fever is an example of positive feedback. Describe the fever response and discuss why the body might initiate this response. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Fever occurs when the thermoregulatory set point in the hypothalamus is reset to a higher level | 1 |
| Causing the body to create heat by shivering/ increased metabolic rate causing a rapid rise in body temperature | 1 |
| It occurs in response to infection with pathogens | 1 |
| To attempt to kill the pathogens by disrupting their metabolism | 1 |
| **Total** | **4** |

**Question 39 (14 marks)**

A runner ran in a 1500 meter race. After the race she noticed that her breathing rate was much faster than usual, but returned to a normal rate a few minutes after she finished.

1. Name and state the location in the body of the structures involved in homeostatic control of breathing. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Peripheral Chemoreceptors | 1 |
| In the Aorta/ Carotid arteries | 1 |
| Central Chemoreceptors | 1 |
| Medulla Oblongata | 1 |
| **Total** | **4** |

1. What is the modulator for homeostatic control of breathing? (1 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Medulla Oblongata | 1 |
| **Total** | **1** |

1. Exercise increases cellular respiration which decrease the pH of the blood. Explain how this happens? (3 mark)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Cellular respiration produces H2O and CO2 | 1 |
| CO2 dissolves in water to form carbonic acid | 1 |
| Then broken down to form bicarbonate ions and Hydrogen ions | 1 |
| **Total** | **4** |

1. Increased heat produced during exercise can be removed from the body several ways. Name and describe three methods of heat loss. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| **Any three of the following** | |
| Conduction  Removal of heat by touching a solid object | 1-2 |
| Convection  Heat being lost from the body through gases or liquids | 1-2 |
| Radiation  Heat lost by electromagnetic radiation | 1-2 |
| Evaporation  Heat lost through the evaporation of sweat on the skin | 1-2 |
| **Total** | **6** |

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

This section contains **four** questions. You must answer **two** questions.

Answer **one** question from 40 and 41 and **one** question from 42 and 43.

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.

Supplementary pages for planning/continuing your answers to a question are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 50 minutes.

Answer **one** question from Questions 40 to 41.

Indicate the questions you will answer by ticking the box next to the question. Write your answers on pages that follow.

**Question 40 (20 marks)**

Production of testosterone is controlled by genes that are stimulated in males during puberty.

1. Testosterone is released by the gonads, but its production is controlled by the pituitary gland and the hypothalamus. Describe the pathway for the production of testosterone. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| The hypothalamus detects low levels of testosterone | 1 |
| The hypothalamus sends releasing factors to the anterior pituitary | 1 |
| To stimulate the anterior pituitary to release FSH and LH/ FSH/LH | 1 |
| FSH and LH/FSH/LH travel through the blood stream | 1 |
| They attach to receptors in the testes | 1 |
| To stimulate the production of testosterone | 1 |
| **Total** | **6** |

1. Testosterone is a lipid-soluble hormone. Explain how testosterone enters and affects the functioning of its target cell. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Testosterone diffuses easily through the cell membrane | 1 |
| Once inside the cell, Testosterone binds to a receptor | 1 |
| Forming a hormone receptor complex/HRC | 1 |
| The hormone/HRC is transported to the nucleus | 1 |
| Where it binds directly to the DNA | 1 |
| Where it activates transcription of certain genes | 1 |
| **Total** | **6** |

1. The other type of hormones the body releases are water soluble hormones. Describe how these hormones enter and effect the functioning of the target cell. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Water soluble hormones do not enter the cell manual | 1 |
| They attach to receptors on the cell-membrane | 1 |
| Causes a secondary messenger to be produced | 1 |
| That diffuses through the cell to activate enzymes | 1 |
| **Total** | **4** |

1. Compare and contrast water-soluble and lipid soluble hormones with respect to their action within the body. (4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Both lipid and water-soluble hormones cause changes in the body to maintain homeostasis | 1-4 |
| Lipid hormones are slow to take an effect |
| Lipid hormones have a long-lasting effect |
| Water soluble hormones cause a rapid response |
| Water soluble hormones have a short-lasting effect |
| **Total** | **4** |

**Question 41 (20 marks)**

In 2007 a woman entered a competition where participants had to drink 240mL of water every 15 minutes without urinating. She came second and later died due to water intoxication.

1. Describe the homeostatic mechanism that occurs when water levels in the blood increase. (10 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Osmoreceptors in the blood vessels detect increased water levels in the blood/ decreased osmolarity | 1-10 |
| Osmoreceptors send a signal to the hypothalamus |
| Hypothalamus sends signals to the posterior pituitary |
| To decrease the release of Anti-diuretic hormone |
| Low ADH decreases the permeability of the DCT |
| Low ADH decreases the permeability of the DCT |
| A lack of ADH will prevent reabsorption in the collecting duct |
| Causing an decrease in urine concentration |
| Hypothalamus sends signal to the anterior pituitary |
| To decrease production of Adrenocorticotrophic hormone (ACTH) |
| Low ACTH decrease production of Aldosterone |
| Low Aldosterone causes decreased reabsorption of the filtrate back to the blood |
| **Total** | **10** |

1. What would happen to the cells the in the blood stream if the fluid increased but was not allowed to be released.

(4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Osmotic pressure in the blood would decrease | 1 |
| Red blood cells would absorb water | 1 |
| Causing them to swell and explode | 1 |
| Reducing the ability of the blood to transport O2 andCO2 | 1 |
| **Total** | **4** |

1. A person was in a hot dry environment with a limited water supply. Describe the hormonal response would occur to conserve fluid levels in their blood.

(6 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Osmotic pressure in the blood would increase | 1 |
| This would be detected by thermoreceptors in the hypothalamus | 1 |
| This would cause a release of ADH from the posterior pituitary | 1 |
| ADH travels in the blood to the distal convoluted tubule/ collecting duct of the nephron | 1 |
| Causes increased permeability of water at this membrane | 1 |
| Causing more water to be reabsorbed from the filtrate/urine | 1 |
| **Total** | **6** |

Answer **one** question from Questions 42 to 43.

Indicate the questions you will answer by ticking the box next to the question. Write your answers on pages that follow.

**Question 42 (20 marks)**

Jessie was skateboarding when she fell and scraped her knee badly on some dirty gravel. To protect Jessie from pathogens, her body underwent a series of responses.

1. Outline the inflammatory response that Jessie’s body would undergo as a result of her fall.

(6 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Damage to the tissue | 1 |
| Mast cells release histamine and heparin | 1 |
| Histamine increases blood flow to the area/capillaries become more permeable | 1 |
| Heparin prevents clotting in the immediate area | 1 |
| Mast cells attract macrophages to the site | 1 |
| Macrophages consume debris and foreign materials | 1 |
| **Total** | **6** |

1. After the initial injury her body started to undergo the antibody mediated response. Outline this response.

(8 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Pathogen enters the body | 1-8 |
| Macrophage engulfs pathogen |
| Macrophages present the non-self antigen / fragment |
| B-Cells are sensitised and enlarged |
| B-cells divide producing clones |
| Most B-cells will become plasma cells |
| Plasma cells will produce antibodies |
| Antibodies travel in the blood stream |
| Antibodies inactivate or destroy antigens |
| Some B-cells become memory cells |
| **Total** | **8** |

1. Compare and contrast the antibody mediated response with the cell-mediated response. (6 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Both are specific responses to pathogens | 1 |
| Both use cells that originate in the bone marrow | 1 |
| Both create memory cells | 1 |
| Antibody mediated use B-Cells, Cell mediated use T-Cells | 1 |
| Antibody mediated occurs when body cells have not been infected with the pathogen, cell mediated when cells have been infected with the pathogen | 1 |
| Antibody mediated uses antibodies in the blood stream produced by B-Cells, cell mediated T-cells travel in the blood | 1 |
| **Total** | **6** |

**Question 43 (20 marks)**

The nervous system is divided into several sections based on structure and function.

1. Compare and contrast the CNS and the PNS. (6 marks)

(ii) The PNS is divided into the somatic and autonomic divisions. What are the main features of the somatic division? (4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| **(i)A maximum of 6 marks for the following** | |
| Both are made up of nervous tissue | 1-6 |
| Both use electro-chemical signalling/action potentials/ nerve impulses |
| Both CNS and PNS involve both automatic and voluntary processes |
| CNS is made of the brain and spinal cord, the PNS is made of the nervous tissue in the rest of the body |
| The nerves in the CNS are made of a huge variety of structural neurons, Nerves in the PNS are mostly sensory/unipolar and motor/multipolar |
| The CNS only has one division (brain and spinal cord), the PNS has many divisions |
| The CNS does not contain any sense receptors, the PNS does |
| The nerves in the CNS are protected by multiple structures/skull/spinal column/CSF/meninges, the nerves in the PNS have less protection |
| **(ii)A maximum of 4 marks for the following** | |
| The somatic division is responsible for voluntary actions | 1-4 |
| The somatic division is also responsible for reflex arc |
| The somatic division contains afferent and efferent neurons |
| The somatic division can be divided into visceral muscles and skeletal muscles |
| **Total** | **10** |

1. On Christmas afternoon a person lays down on the couch following a large meal. Which division of the autonomic system would be engaged and what would the physiological effects on the person be?

(6 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| The parasympathetic division of the NS | 1-6 |
| Constriction of blood vessels to skeletal muscles |
| Dilation of blood vessels to digestive organs |
| Stimulation of digestive secretions |
| Increased peristalsis/ relaxation of sphincters in the digestive system |
| Decrease heart rate |
| Constriction of bronchioles |
| Constriction of pupils |
| **Total** | **6** |

1. This person has a sleep on the couch but wakes up when they feel something strange on their right elbow. They slap the elbow and open their eyes to discover a squashed mosquito. Outline the pathway of nerve impulses from feeling the mosquito to slapping the mosquito.

(4 marks)

|  |  |
| --- | --- |
| **Description** | **Mark** |
| Touch receptors in the skin are stimulated by the mosquito | 1 |
| Nerve impulses are sent to the CNS by sensory neurons | 1 |
| Impulse sent to the parietal lobe to interpret the stimuli | 1 |
| Impulse sent via a motor nerve to the arm to slap the mosquito | 1 |
| **Total** | **4** |

**END OF QUESTIONS**

**ACKNOWLEDGEMENTS**

**Question 10** Adapted fromNeuron [image] retrieved 9 December, 2020 from <https://search.creativecommons.org/photos/7a4312df-fc7b-43dd-928c-e4ff32519bde>

**Question 13** Adapted from image retrieved 24 February, 2020 from <https://en.wikipedia.org/wiki/Pituitary_gland#/media/File:1806_The_Hypothalamus-Pituitary_Complex.jpg>

**Question 17** Neuromuscular junction[image] retrieved 16 January, 2020 from <https://en.wikipedia.org/wiki/Neuromuscular_junction>

**Question 22** Adapted from brain image retrieved 16 December, 2020 from <https://upload.wikimedia.org/wikipedia/commons/2/23/Brain_diagram_without_text.svg>

**Question 32** Adapted fromNeuron [image] retrieved 9 December, 2020 from <https://upload.wikimedia.org/wikipedia/commons/0/00/Sketch_of_a_brain_neuron.png>

**Question 33** Adapted from endocrine system [image] retrieved 15 December, 2020 from: <https://upload.wikimedia.org/wikipedia/commons/d/da/Illu_endocrine_system_heb_%28cropped%29.PNG>

**Question 35** TTX [graph] retrieved 5 December, 2020 from: <https://en.wikipedia.org/wiki/Neurotoxin#/media/File:Tetrodotoxin_AP.png>