MATER DEI COLLEGE
FAITH WITH COURAGE

HUMAN BIOLOGY ATAR

Unit 3

2022

Name: _____

Student Number:

In figures | | | | | | | | |

In words _____

_____

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 answer		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 for this section: 40 minutes.

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1. The role of helper T cells is to

   (a) destroy cells that are infected with bacteria.
   (b) control the adaptive immune response.
   (c) generate antibodies.
   (d) engulf parasites.

2. Which of the following is a feature common to both T cells and B cells?

   (a) Creating memory cells
   (b) Rapidly responding to pathogens after the first exposure
   (c) Being able to physically attach to pathogens
   (d) Being able to travel through the bloodstream

3. Negative feedback occurs when

   (a) the initial stimuli is reinforced.
   (b) the initial stimuli is maintained.
   (c) the initial stimuli is reversed.
   (d) the initial stimuli is stopped.

4. Which of the following is an **incorrect** comparison between the autonomic and somatic nervous systems?

   (a) The autonomic NS is involuntary, and the somatic NS is voluntary.
   (b) The effectors of the autonomic NS are smooth muscles, the effectors of the somatic NS are skeletal muscles.
   (c) Acetylcholine has an excitatory effect in the autonomic NS and an inhibitory effect in the somatic NS.
   (d) The autonomic NS has motor pathways only whereas the somatic NS has sensory and motor pathways.

Questions 5 and 6 refer to the statement below.

A researcher was attempting to determine the impact of the sweating response when different concentrations of adrenaline were administered to allergy sufferers having an allergic reaction.

5. What was the independent variable of this experiment?

   (a) Sweating response
   (b) Administered adrenaline
   (c) Allergic reaction
   (d) Allergy suffering individuals

6. What was the dependent variable of this experiment?

   (a) Sweating response
   (b) Administered adrenaline
   (c) Allergic reaction
   (d) Allergy suffering individuals

7. Which of the following is a behavioural response to **increased** body temperature?

   (a) Increased sweating
   (b) Splashing cold water on your face
   (c) Putting on a jumper
   (d) Vasodilation

8. The endocrine organ that produces the hormone calcitonin is the

   (a) thyroid gland.
   (b) parathyroid gland.
   (c) adrenal medulla.
   (d) adrenal cortex.

9. Which of the following comparisons of type I and II diabetes is **incorrect**?

   (a) Type I diabetes occurs earlier in life and type II diabetes occurs later in life.
   (b) Type I diabetes can be caused by autoimmune issues and type II is can be caused by lifestyle.
   (c) Both type I and II diabetes require insulin injections.
   (d) Both type I and II diabetes require careful monitoring of diet.

10. A hypothesis may be accepted by the scientific community if the

    (a) the sample size tested is over 20% of the population.
    (b) the data collected shows a difference between the experimental and control.
    (c) the data collected supports the hypothesis.
    (d) other researchers peer-review and obtain similar results.

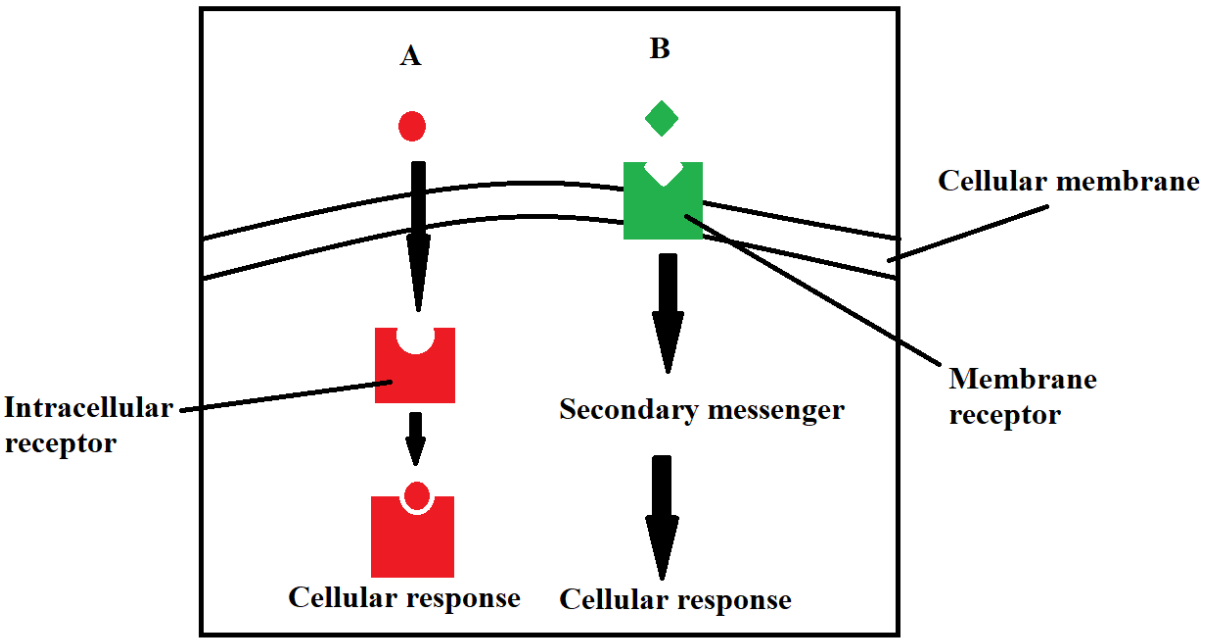
11. The clear liquid which fills the space between the membranes of the brain is

(a) plasma.
(b) lymph.
(c) cerebrospinal fluid.
(d) intracellular fluid.

12. Stimulation of the parasympathetic nervous system would cause

(a) heart rate to increase.
(b) dilation of the pupils.
(c) stimulation of the digestive system.
(d) decreased sweat production.

Question 13-15 refers to the diagram below.



13. Which of the following show the correct names of the hormones shown above?

(a) A is a lipid soluble hormone and B is a water-soluble hormone.
(b) B is a lipid soluble hormone and A is a water-soluble hormone.
(c) A and B are both lipid soluble hormones.
(d) A and B are both water soluble hormones.

14. Which of the following is a correct description of **speed** of hormonal action?

(a) Water-soluble and lipid soluble hormones both have a rapid action
(b) The speed of action is not determined by hormone type
(c) Water-soluble hormones have a more rapid action than lipid soluble hormones
(d) Lipid soluble hormones have a more rapid action than water-soluble hormones

15. Which of the following is a correct description of the **duration** of hormonal action?

(a) Water-soluble and lipid soluble hormones both have a long duration
(b) The duration is not determined by hormone type
(c) Water-soluble hormones have a longer duration than lipid soluble hormones
(d) Lipid soluble hormones have a longer duration than water-soluble hormones

16. In nervous transmission, how is the impulse propagated along the fibre?

(a) Active transport
(b) Exocytosis
(c) Osmosis
(d) Facilitated diffusion

17. Some human cells, such as mast cells, produce cytokines. A major function of cytokines is

(a) signalling immune cells in inflammatory response.
(b) stimulating B cells to directly attack virally infected cells.
(c) diffusing across the synaptic gap to stimulate adjacent cells.
(d) Communicating with distant cytokine producing cells

18. Which of the following pairings is **incorrect**?

(a) hormone: luteinising hormone; target organ: testes
(b) hormone: antidiuretic hormone; target organ: kidney
(c) hormone: oxytocin; target organ: ovary
(d) hormone: thyroid stimulating hormone; target organ: thyroid

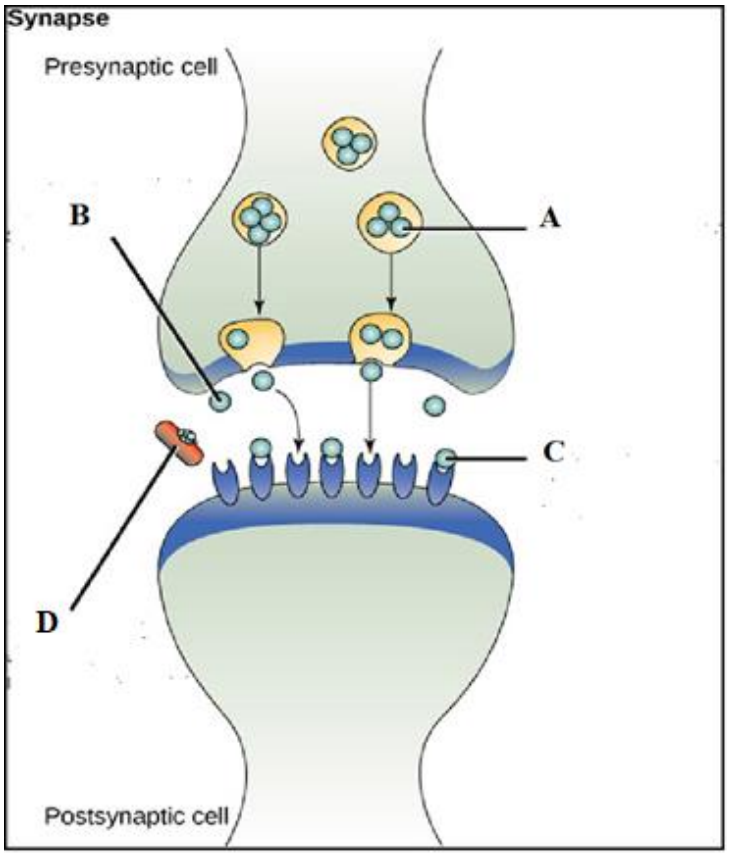
19. What immediate effect would the removal of the pancreas have on the composition on the persons urine?

(a) Amino acids appear in the urine
(b) Glucose appears in the urine
(c) The urine contains more creatine
(d) The urine contains a greater concentration of salts

20. A drastic underproduction of antidiuretic hormone could result in

(a) reduced thirst.
(b) retention of water in the body.
(c) increased urine concentration.
(d) excessive urine production.

Use the diagram below to answer Questions 21-23



21. Which label shows the neurotransmitter released into the synapse?

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

22. What is the function of D?

(a) Breaks down the neurotransmitter after it is released from the receptor
(b) Breaks down the neurotransmitter to stop it from attaching to the receptor
(c) Breaks down the neurotransmitter if there are too many in the synapse
(d) Breaks down the neurotransmitter and receptor protein

23. The release of neurotransmitters into the synapse is triggered by the influx of Ca^{2+} into the presynaptic cell. How does this Ca^{2+} impact transmission at the synapse?

(a) The Ca^{2+} stimulates neurotransmitter production
(b) The Ca^{2+} causes neurotransmitter to be packaged into vesicles.
(c) The Ca^{2+} causes neurotransmitter vesicles to migrate to the plasma membrane
(d) The Ca^{2+} causes neurotransmitter vesicles to empty into the synapse by exocytosis

24. The receptor that detects a need for an increase in breathing would be most sensitive to which of the following factors?

    (a) Blood pressure
    (b) Blood oxygen concentration
    (c) Blood osmotic pressure
    (d) Blood carbon dioxide concentration

25. The part of the brain most associated with the coordination of fine motor control is the

    (a) medulla oblongata.
    (b) cerebrum.
    (c) cerebellum.
    (d) hypothalamus.

26. Which is the best definition of “validity” according to the scientific method?

    (a) baseline data to compare experiment results to
    (b) the extent to which an experiment produces consistent results
    (c) the extent to which a concept is correctly and precisely measured
    (d) the extent to which the test measures what was intended

Use the table below to answer Questions 27 and 28.

Disease	**Pathogen**
Malaria	protozoa
Influenza	virus
Measles	virus
Bubonic Plague	bacteria
Ringworm	fungus

27. Which of these diseases would be treated effectively with antibiotics?

    (a) Malaria
    (b) Measles
    (c) Bubonic Plague
    (d) Ringworm

28. What type of medication could be used to treat the symptoms of influenza?

    (a) Bacteriostatic antibiotics
    (b) Bactericidal antibiotics
    (c) Anaesthetics
    (d) Antivirals

29. Many experiments have an ‘experimental’ and a ‘control’ group. Which of the following statements regarding these two groups is correct?

    (a) The control group is identical to the experimental group except for the independent variable
    (b) The control group may have several differences between the experimental group
    (c) The control group must be twice the size of the experimental group
    (d) Participants are aware of which group they are in

30. A Human Biology student was investigating the impact of regular aerobic exercise on high school students’ ability to focus in class.

    Which of the following variables would **NOT** need to be controlled to ensure valid results?

    (a) Sex of the participants
    (b) Diet of the participants
    (c) Hours of sleep for the participants
    (d) Consistent measurement tool to determine focus

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

This section has **seven** 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 for this section: 90 minutes.

Question 31 **(18 marks)**

Athletes training for sports with specific weight divisions like boxing and weightlifting participate in 'cutting weight' to be placed in the lowest weight category possible. One method used by these athletes is to dehydrate themselves before being weighed to cut as much water weight from their body as possible.

A long-term effect of dehydration is kidney damage. A researcher wants to investigate the possible long-term consequences on kidney function for athletes who practice 'cutting weight'. The test that the researcher will use to determine kidney function is the Glomerular Filtration Rate (GFR).

(a) Describe a control group that could be used for this study. (2 marks)

_____

_____

(b) Suggest a method that the researcher could employ to test the hypothesis. 'Athletes in their 20's who practise 'cutting weight' have reduced kidney function as measured by the GFR compared to a control group'.

(5 marks)

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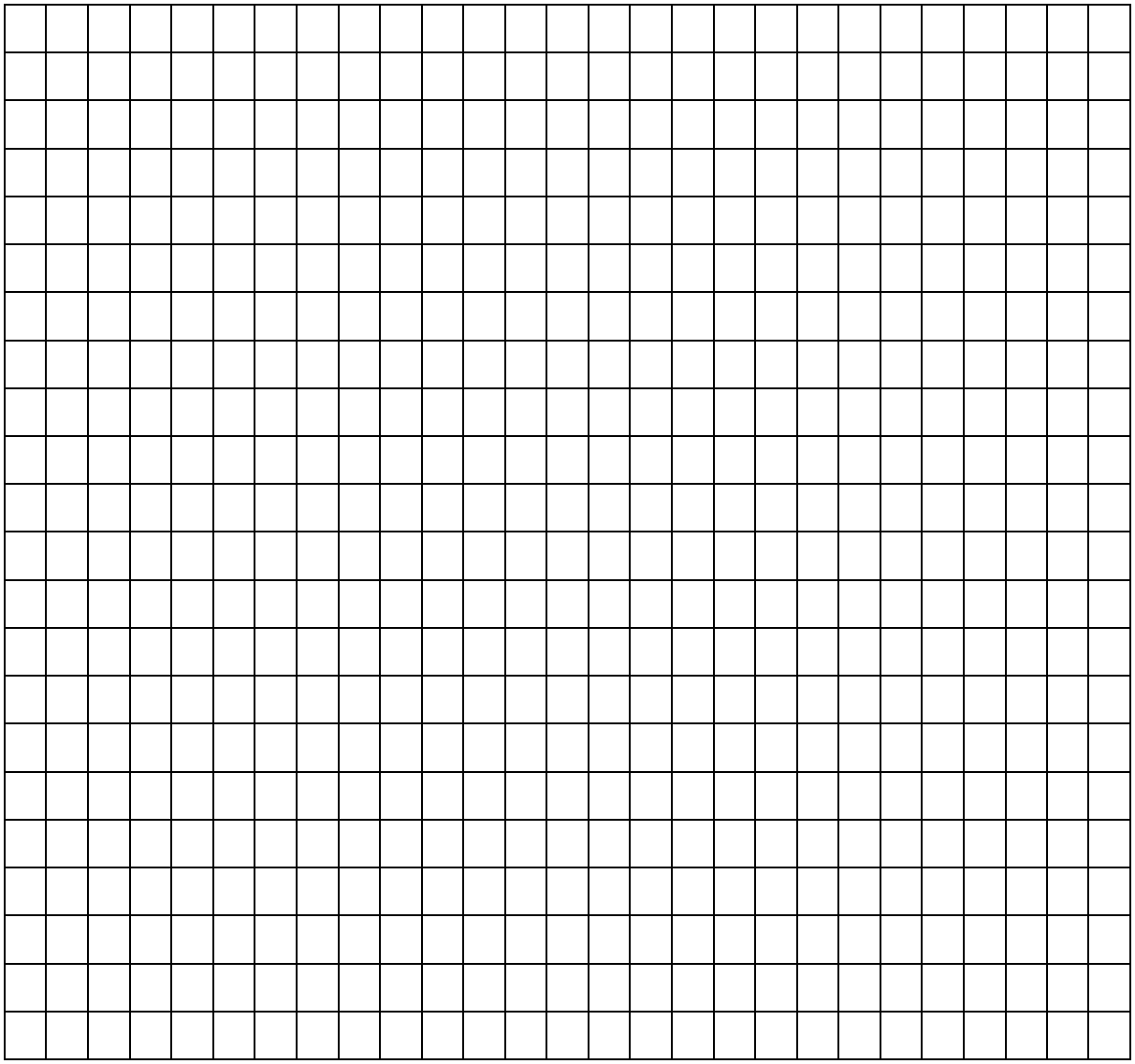
The researcher found the following results.

Experimental Group	GFR	Control Group	GFR
Participant 1	90	Participant 1	95
Participant 2	72	Participant 2	92
Participant 3	63	Participant 3	88
Participant 4	80	Participant 4	73
Participant 5	55	Participant 5	97

(c) Using the grid below, graph the **mean** for each of the groups.
Spare grid available at back of booklet. (5 marks)



(d) Determine the **median** GFR for each group. (2 marks)

Experimental:_____

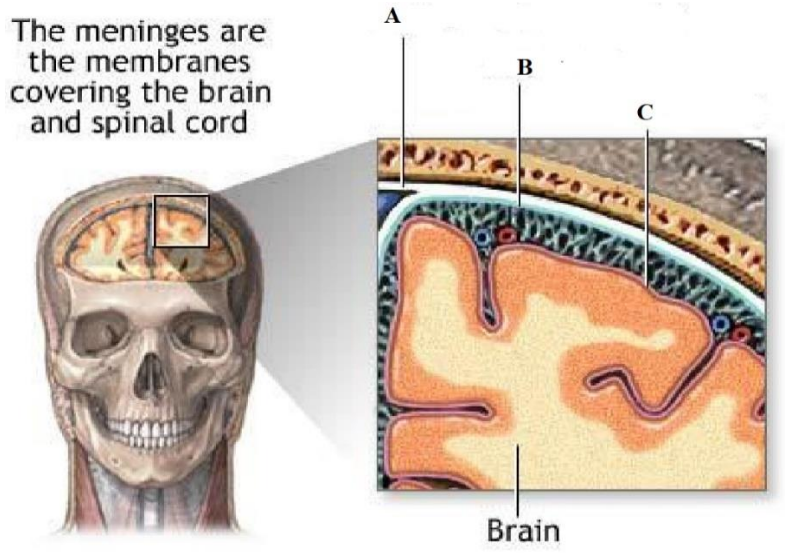
Control:_____

(e) State a conclusion that could be made based on the results of this study. (1 mark)

(f) While a long-term effect of dehydration is kidney damage, describe the short-term physiological response to dehydration. (3 marks)

Question 32 **(9 marks)**

Synapse Australia's Brain Injury Organisation is a non-profit organisation that supports people who suffer brain injuries. You are considering volunteering for this organisation. As part of the recruitment process, you need to demonstrate understanding of structures of the brain and implications of injuries to various sections.



(a) Name the structures shown in the diagram above. (3 marks)

A:_____

B:_____

C:_____

(b) Describe how the cerebrospinal fluid (CSF) and the cranium provide additional protection for the brain. (2 marks)

CSF:_____

_____

_____

Cranium:_____

_____

_____

_____

(c) There are many effects of traumatic brain injury. For each of the symptoms suggest a part of the brain most likely to have received the injury.

(4 marks)

Symptom	**Part of the brain**
A loss of taste and smell	
Being able to initiate movement but having difficulty coordinating fine motor functions.	
Inability to breathe without a respirator.	
Extreme emotional outbursts.	

Question 33 **(12 marks)**

Hormones are chemical messengers that cause changes in the body.

(a) Describe how hormones are transported to target cells throughout the body.

(3 marks)

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Some hormones occur in antagonistic pairs. This is when hormones have opposite effects on the body.

(b) Complete the table below to identify the antagonistic hormones.

(4 marks)

Hormone	Effect on the Body
	Secreted when blood calcium is high to supress breakdown of the bone matrix.
	Secreted when blood calcium is low and increases calcium absorption in the intestines.
	Secreted when blood glucose is low to cause glucose production from glycogen.
	Secreted when blood glucose is high to cause glycogen production from glucose.

(c) Growth hormone deficiency (GHD) is a disorder that is caused by the underproduction of growth hormone in the body.

i. Name the endocrine gland that produces growth hormone.

(1 mark)

_____

ii. Describe **two (2)** functions of growth hormone on the body.

(2 marks)

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iii. Suggest **two (2)** symptoms a person may suffer because of the underproduction of growth hormone if they suffer with GHD.

(2 marks)

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Question 34 **(15 marks)**

Homeostasis is a series of processes in order to keep the human body within a narrow set of tolerance levels.

(a) Describe how the term ‘dynamic equilibrium’ could be applied to the concept of homeostasis. (3 marks)

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(b) Complete the table below to show the missing homeostatic mechanism, modulator, and receptors. (6 marks)

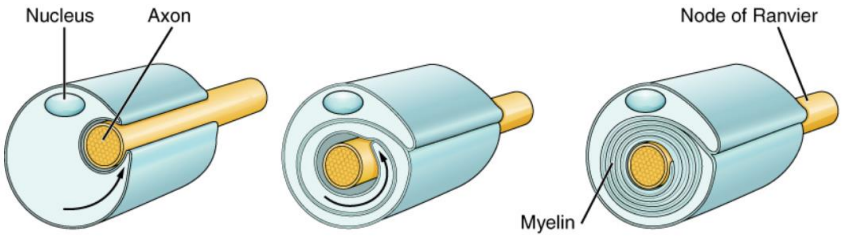
Homeostatic Mechanism	Modulator	Receptor
Thermoregulation	Hypothalamus	
Blood gas concentration		Chemoreceptors
	Islets of Langerhans in the Pancreas	
Blood water concentration		

(c) Describe the processes that the body goes through to maintain stable blood sugar levels in the blood if blood sugar levels decrease.

(6 marks)

Question 35 **(20 marks)**

The diagram below shows the process of myelination of an axon



(a) What is the name of the cell that creates the myelin sheath in the PNS? (1 mark)

_____

Guillain-Barré syndrome (GBS) is a rare disorder where the body's immune system damages the myelin sheath of neurons. The damage to the nerves causes muscle weakness and sometimes paralysis. While its cause is not fully understood, the syndrome often follows infection with a virus and is most often found in people over 50. The cells of the autonomic nervous system are affected which can cause heart-rate irregularities.

(b) Identify **two (2)** functions of the myelin sheath. (2 marks)

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_____

_____

(c) Explain how damage to the myelin sheath can cause muscle weakness and paralysis. (3 marks)

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(d) Compare and contrast how nervous propagation occurs along myelinated and unmyelinated axons. (6 marks)

(e) Complete the following table to contrast the effects of the sympathetic and parasympathetic divisions of the autonomic nervous system on various organs. (8 marks)

Organ	Sympathetic division	Parasympathetic division
Heart		
Blood vessels		
Salivary Glands		
Sweat glands		

Question 36 **(15 marks)**

In 2021 three different vaccines were released to the Australian public to protect them from contracting the corona virus. They were AstraZeneca, Pfizer and Moderna. AstraZeneca was a vaccine that was made using a live attenuated viral vector while Pfizer and Moderna were both RNA vaccines.

(a) Describe the features of live attenuated vaccines. (2 marks)

(b) Name and describe **two (2)** other types of vaccines. (4 marks)

(c) Explain how vaccines work to provide immunity against infection. (4 marks)

The Western Australian government set a mandate to open the borders when the vaccination rate was predicted to reach 90% of double vaccinations. The reason for this was to achieve 'herd immunity'.

(d) What is 'herd immunity' and how does it reduce infection? (3 marks)

In January 2022 the West Australian government announced that people who had been double vaccinated could get a booster vaccine 3 months after their initial vaccine.

(e) How does a booster vaccine increase immunity? (2 marks)

Question 37 **(11 marks)**

The lymphatic system has many functions in the body to remove mutated cells, virally infected cells and non-self-antigens from the body

(a) Name one cell that removes virally infected cells and describe its function. (2 marks)

_____

_____

_____

(b) Name and describe the function of **one (1)** cell that incapacitates non-self-antigens and removes them from the body. (2 marks)

_____

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In 2001 there was a series of letters that were sent throughout the US that contained the infectious bacterium anthrax.

(c) Describe the series of events the body would go through between being infected with the bacterium anthrax, which invades the hosts blood stream and produces toxins, to recovery. (7 marks)

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

This section contains **four (4)** questions. You must answer **two (2)** questions. Answer **one** question from 38 and 39 and **one** question from 40 and 41.

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 for this section: 40 minutes.

Answer <u>one</u> question from Questions 38 to 39.

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

☐ **Question 38** **(20 marks)**

Secretion of hormones from the pituitary is controlled by the hypothalamus.

(a) Compare and contrast the hypothalamic control of hormone secretions from the anterior and posterior pituitary. (10 marks)

The hypothalamus is considered as the link between the nervous system and the endocrine system.

(b) The nervous system is divided into a number of important divisions. Describe the organisation and functions of the Central and Peripheral Nervous Systems.
(10 marks)

☐ **Question 39** **(20 marks)**

The hypothalamus controls human metabolic rate.

(a) Describe the response, initiated by the hypothalamus, to a decrease in metabolic rate.
(10 marks)

Conditions affecting the endocrine system can cause disruptions to homeostasis

(a) Compare and contrast how diabetes and hypothyroidism cause disruptions to homeostasis. Your answer should also consider causes, symptoms and treatments.
(10 marks)

Answer <u>one</u> 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)**

Amber has just given birth to a baby boy, Arno. Already, Arno has immunity for a range of diseases.

(a) Describe the ways Arno would acquire passive immunity from Amber and speculate about how long this immunity would be effective.

(6 marks)

(b) At approximately 2 months of age, Arno is ready to get his first vaccination. What are some of the social, cultural and economic contexts that might influence Amber's decision to get Arno vaccinated?

(9 marks)

Antibody serum injections are another way in which immunity can be gained.

(a) Identify the type of immunity antibody serum injections infer and explain how the immunity is conveyed to the recipient.

(5 marks)

Question 41 **(20 marks)**

Pedro was cooking dinner for his family. He accidently picked up the pan he had just removed from the oven with his bare hands and instantly dropped the meal on the floor. A fraction of a second later Pedro felt the searing pain in his hands resulting from touching the hot pan. He saw that the burn had removed his skin exposing the flesh beneath.

(a) Describe the nervous pathway of the message that resulted from Pedro picking up the hot pan.

(10 marks)

Pedro sought medical assistance for his burn and was treated with a topical ointment that blocked pain receptors in the skin.

(b) Explain how this treatment would have helped alleviate Pedro's symptoms.

(4 marks)

(c) Pedro's burned area underwent the inflammatory response as a reaction to the burn. Describe what would have occurred at the site of the burn.

(6 marks)

End of Questions

Question number(s): ……

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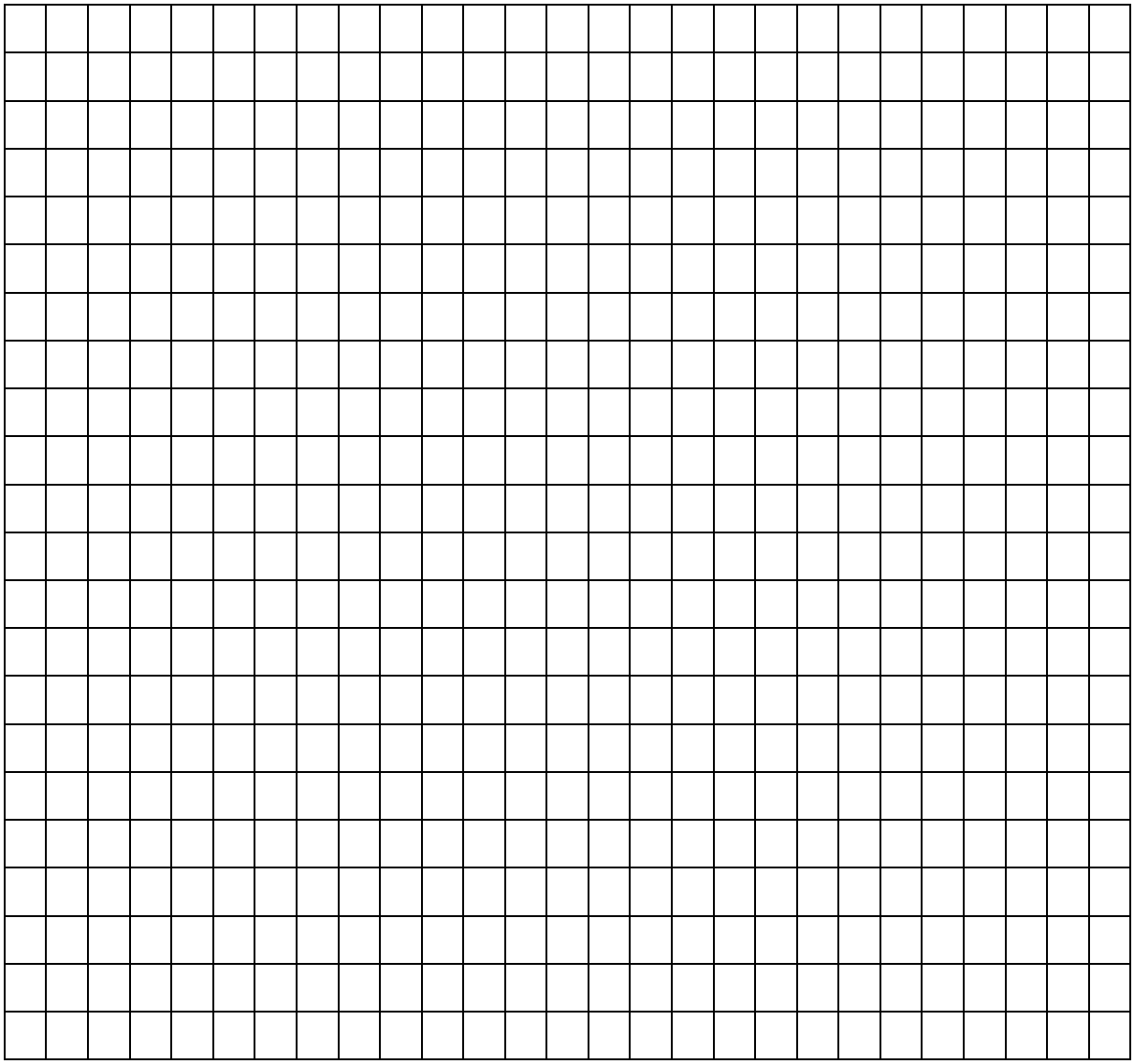
Spare grid



Additional working space

Question number(s): ……

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