



**MATER DEI**  
**COLLEGE**  
FAITH WITH COURAGE

# HUMAN BIOLOGY ATAR

## Unit 3

### 2022

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

**Student Number:**

In figures

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In words

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### **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
<b>Section One:</b> Multiple-choice	30	30	40	30	30
<b>Section Two:</b> Short answer	9	9	90	100	50
<b>Section Three:</b> Extended answers	40-41	2	50	40	20
	42-43	2			
<b>Total</b>					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.

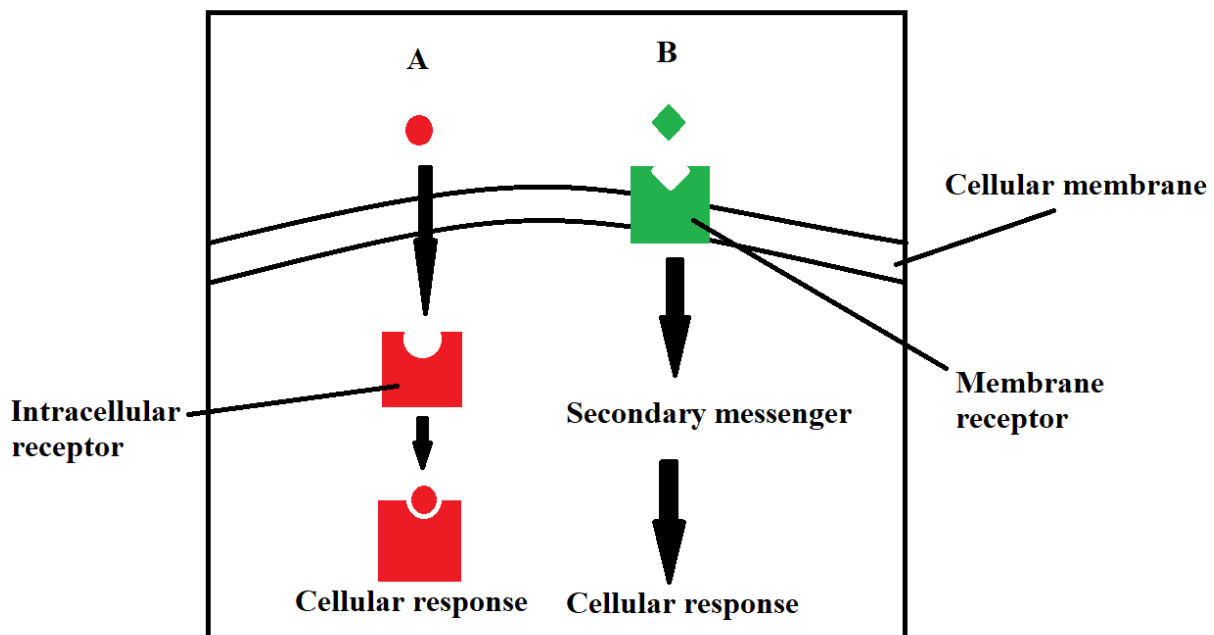
11. The clear liquid which fills the space between the membranes of the brain is

- (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?

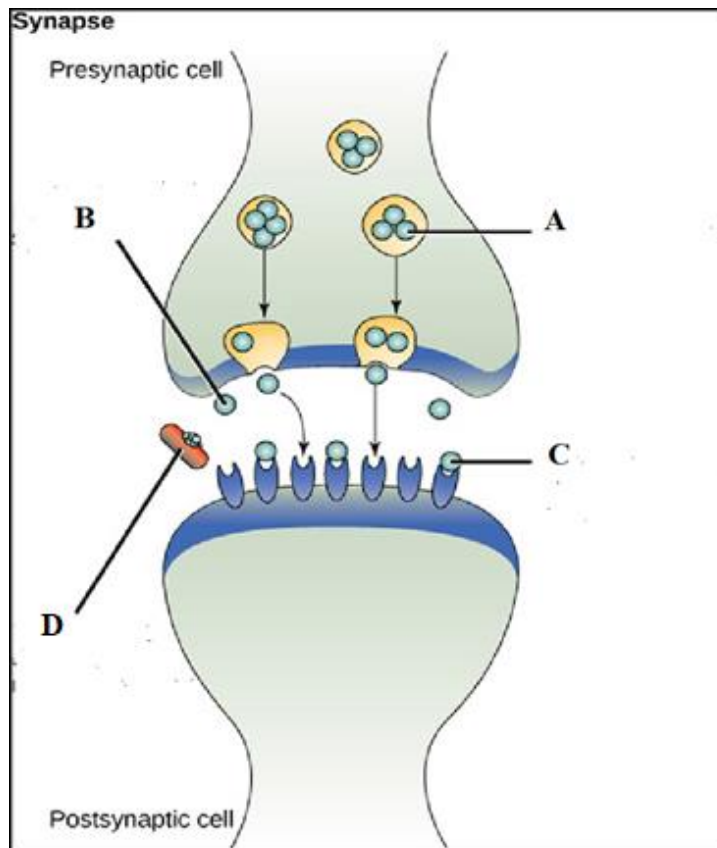
- (a) A is a lipid soluble hormone and B is a water-soluble hormone.
- (b) B is a lipid soluble hormone and A is a water-soluble hormone.
- (c) A and B are both lipid soluble hormones.
- (d) A and B are both water soluble hormones.

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  $\text{Ca}^{2+}$  into the presynaptic cell. How does this  $\text{Ca}^{2+}$  impact transmission at the synapse?

- (a) The  $\text{Ca}^{2+}$  stimulates neurotransmitter production
- (b) The  $\text{Ca}^{2+}$  causes neurotransmitter to be packaged into vesicles.
- (c) The  $\text{Ca}^{2+}$  causes neurotransmitter vesicles to migrate to the plasma membrane
- (d) The  $\text{Ca}^{2+}$  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.

<b>Disease</b>	<b>Pathogen</b>
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.

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**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)

Athletes	1 mark
Who do not practise 'cutting weight'	1 mark

- (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)

Select participants made up of athletes in their 20's	1 mark
Divide the group into an experimental and control group.	1 mark
The experimental group is made up of athletes who cut weight and the control group is made up of athletes who do not cut weight.	1 mark
Test the kidney function of both groups using GFR	1 mark
Compare the kidney function of the two groups	1 mark

Other correct methods may be accepted

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)

Means calculated correctly – Exp = 72, Control = 89	1 mark
Meaningful title – includes both variables	1 mark
Axis labels	1 mark
Units (not applicable)	
Even scale	1 mark
Correct plotting/type of graph - Bar	1 mark

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

(2 marks)

Experimental: 72	1 mark
Control: 92	1 mark

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

Cutting weight causes decreased GFR	1 mark
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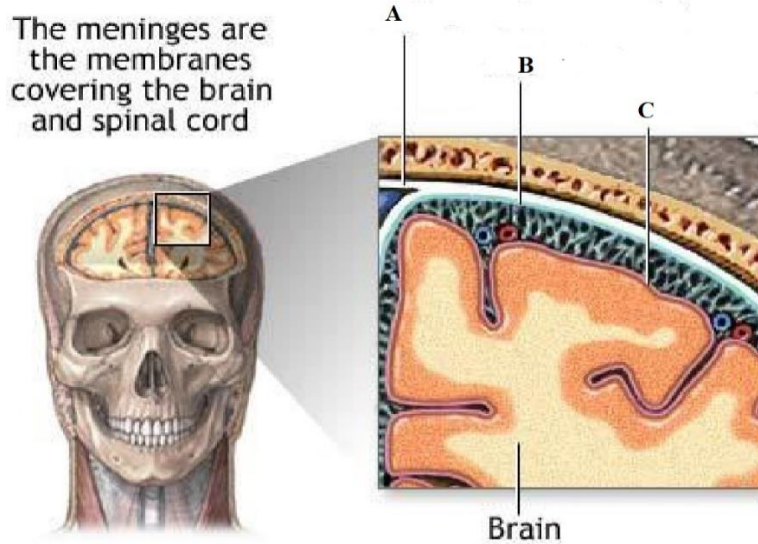
(f) While a long-term effect of dehydration is kidney damage, describe the short-term physiological response to dehydration. (3 marks)

Increase production of ADH	1 mark
Increases permability of DCT and CD	1 mark
Increased reabsorption of water into the blood	1 mark

**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: Dura(mater)	1 mark
B: Arachnoid	1 mark
C: Pia(mater)	1 mark

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

CSF: Provides a fluid cushion/buffer OR	1 mark
CSF: Acts as a shock absorber	
Cranium: Defence against physical impact (hard) OR	1 mark
Cranium: Supports the brain inside brain case	

(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)

<b>Symptom</b>	<b>Part of the brain</b>
A loss of taste and smell	<b>Cerebrum/Parietal lobe</b>
Being able to initiate movement but having difficulty coordinating fine motor functions.	<b>Cerebellum</b>
Inability to breathe without a respirator.	<b>Medulla oblongata</b>
Extreme emotional outbursts.	<b>Cerebrum/ Frontal lobe/ Prefrontal cortex</b>

**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)

Hormones are released from endocrine organs into the blood stream	1 mark
They travel in the bloodstream to all cells in the body	1 mark
They attach to target cells that have receptor proteins on the surface/enter the cell through the membrane	1 mark

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)

<b>Hormone</b>	<b>Effect on the Body</b>
<b>Calcitonin</b>	Secreted when blood calcium is high to suppress breakdown of the bone matrix.
<b>Parathyroid Hormone</b>	Secreted when blood calcium is low and increases calcium absorption in the intestines.
<b>Glucagon</b>	Secreted when blood glucose is low to cause glucose production from glycogen.
<b>Insulin</b>	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)

Anterior Pituitary	1 mark
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ii. Describe **two (2)** functions of growth hormone on the body.

(2 marks)

Any two:

Stimulates bone growth	1 mark
Stimulates muscle growth	1 mark
Increased blood concentration of glucose/fatty acids	1 mark
Increases rate of uptake of amino acids into cells for protein synthesis	

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

(2 marks)

Decreased bone density	1 mark
Decreased muscle mass	1 mark
Accept any other correct symptoms including increased fat mass, lack of stamina, fatigue etc	1 mark

**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)

Equilibrium = Homeostasis aims to maintain ideal set point	1 mark
Dynamic = Body undergoes constant/numerous internal changes	1 mark
If levels increase, changes occur in the body to decrease levels (or vice versa)	1 mark

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

<b>Homeostatic Mechanism</b>	<b>Modulator</b>	<b>Receptor</b>
Thermoregulation	Hypothalamus	Thermoreceptors
Blood gas concentration	Medulla	Chemoreceptors
Blood glucose concentration	Islets of Langerhans in the Pancreas	Chemoreceptors
Blood water concentration	Hypothalamus	Osmoreceptors

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

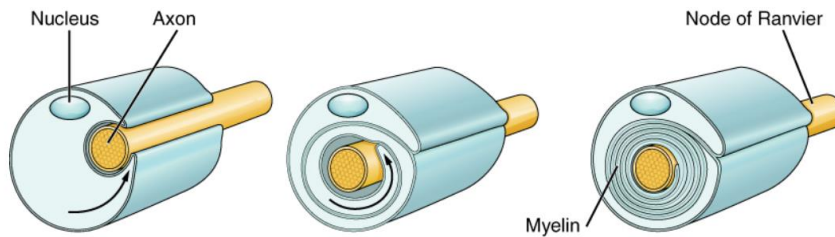
(6 marks)

Stimulus: Blood sugar levels decrease	1 mark
Receptor: Alpha cells of islets of Langerhans <u>detect change</u>	1 mark
Modulator: Alpha cells of islets of Langerhans secrete glucagon	1 mark
Effector: Liver/ Body cells/skeletal muscle	1 mark
Response: Increased gluconeogenesis/glycogenolysis	1 mark
Feedback: Negative/Blood glucose increases	1 mark

**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)

Schwann Cell	1 mark
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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)

Speeds up nerve impulses	1 mark
Insulates axon/protects axon/separates axon from external environment	1 mark

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

Myelination of nerves controlling movement ensures efficient transmission to the effector/allows stimulation of effector	1 mark
<u>Slowing down transmission</u> to effector due to damage to myelin sheath causes <u>muscle weakness</u>	1 mark
<u>Stopping transmission</u> to effector due to damage to myelin sheath causes <u>paralysis</u>	1 mark

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

Myelinated axons propagate the impulse faster	1 mark
Unmyelinated axons propagate the impulse slower	1 mark
Myelinated axons skip impulse between Nodes of Ranvier/ use saltatory conduction	1 mark
Unmyelinated axons have depolarisation occur at all points along the axon	1 mark
Both conducts using an electrochemical impulse	1 mark
Both can transmit inhibitory and excitatory messages	1 mark

Accept other correct answers

- (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	Increase rate and strength of contraction	Decrease rate and strength of contraction
Blood vessels	Constrict vessels	No/little effect
Salivary Glands	Decreases salivary secretions	Increases salivary secretions
Sweat glands	Increases sweat secretions	No effect

**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)

Uses a living version of the pathogen	1 mark
That has been altered to decrease virulence	1 mark

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

(4 marks)

<b>Sub-unit/Conjugate</b>	1 mark
Sub-unit/Conjugate: Uses one part or section of a pathogen	1 mark
<b>Toxoid</b>	1 mark
Toxoid: Uses the inactivated toxin	1 mark
<b>Dead/Inactivated/Killed</b>	1 mark
Dead/Inactivated/Killed: Uses the pathogen that is dead	1 mark

Any two correct vaccine types with appropriate descriptions for 4 marks total

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

(4 marks)

The B-cells in the lymph nodes recognise the vaccine as pathogenic	1 mark
B-cells create antibodies to combat the pathogen	1 mark
Memory cells are created that recognise the pathogen	1 mark
If the person is infected with the virulent pathogen, antibodies will be produced to kill the pathogen before the person becomes sick	1 mark

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)

Herd immunity is where a high proportion of the population has resistance to an infection	1 mark
This causes the spread of infection to slow down and stop due to few hosts being present in the population	1 mark
This protects those without immunity as the spread of infection decreases	1 mark

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)

Booster vaccines cause a secondary immune response which creates new memory cells	1 mark
Immunity is increase due to a higher number of memory cells/ more effective antibodies being produced after the booster vaccine	1 mark

**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)

Killer T-cells	1 mark
Killer T-cell: Contact infected cells directly destroying them	1 mark
Helper T-cells	1 mark
Helper T-cells: Produce cytokines when they recognise virally infected cells	1 mark

Any one with matching description for 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)

B-cells	1 mark
B-cells: Produce antibodies to destroy non-self-antigens	1 mark
Macrophages	1 mark
Macrophages: Engulf non-self-antigens destroying them	1 mark

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)

Toxins damage cells/tissue making person feel unwell/sick	1 mark
Stimulates non-specific responses such as fever/inflammation	1 mark
Macrophages/phagocytes would destroy pathogen & become APC OR Anthrax/toxin would be detected by B-cells in the lymph nodes	1 mark
B-cells are sensitised, enlarge and divide to produce plasma cells	1 mark
Plasma cells produce antibodies that circulate through the blood stream to bind to the specific antigen/anthrax	1 mark
Antibodies dissolve pathogen/tag pathogen for macrophages, make pathogen insoluble/ cause pathogen agglutination	1 mark
Some B-cells become Memory B cells would be created	1 mark



**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 one 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)

<b>Compare:</b>	
The pituitary gland is connected to the hypothalamus by a stalk called the infundibulum	1 mark
The hypothalamus controls the type and quantity of hormones that are secreted by BOTH the anterior and posterior pituitary	1 mark
The hypothalamus has receptors that detect changes in the blood resulting in...	1 mark
The hypothalamus sends signals to BOTH the anterior and posterior pituitary	1 mark
<b>Contrast:</b>	
1 mark for each of the following:	
Anterior Pituitary Gland	Posterior Pituitary Gland
The anterior pituitary is connected to the hypothalamus by a network of blood vessels	The posterior pituitary is connected to the hypothalamus by neural pathways/ neurosecretory cells
The hypothalamus produces releasing factors that are sent to the anterior pituitary to stimulate hormone production.	The hypothalamus produces hormones that it sends to the posterior pituitary via neural networks/neurosecretory cells to be stored
The anterior pituitary produces and secretes hormones in response to releasing factors	The posterior pituitary does not produce its own hormones, it only secretes them through impulses from neurosecretory cells

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)

<b>Central Nervous System</b>	
<b>Organisation:</b> Consists of brain and spinal cord	1 mark
<b>Function (two points for two marks):</b> <ul style="list-style-type: none"> <li>- Interprets sensory information and initiates motor movements</li> <li>- Maintains homeostasis</li> </ul>	2 marks
<b>Peripheral Nervous System</b>	
<b>Organisation:</b> Consists of 12 pairs of cranial nerves and 31 pairs of spinal nerves	1 mark
<b>Function:</b> Afferent/sensory neurons send impulses towards CNS	1 mark
Efferent/motor neurons send impulses away from CNS	1 mark
Somatic divisions carries messages to skeletal muscle	1 mark
Autonomic division carries messages to involuntary muscle and glands	1 mark
Sympathetic nervous system controls fight-or-flight responses	1 mark
Parasympathetic nervous system coordinates responses at times of rest	1 mark



**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)

The hypothalamus detects a decrease in metabolic rate	1 mark
The hypothalamus sends TSH releasing factors to the anterior pituitary	1 mark
Through blood vessels in the infundibulum	1 mark
The anterior secretes TSH	1 mark
TSH travels through the bloodstream	1 mark
Attaching to TSH receptor proteins on the thyroid	1 mark
The thyroid gland secretes thyroxine	1 mark
Thyroxine travels through the blood stream	1 mark
Attaches to all cells that have thyroxine receptor proteins on the surface	1 mark
Causing cells to increase metabolic rate/ rate of reactions/ respiration	1 mark

Conditions affecting the endocrine system can cause disruptions to homeostasis

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

**Must include one comparison in each of the categories (4 total), any other 6 points for 6 marks.**

	<b>Diabetes</b>	<b>Hypothyroidism</b>
<b>Disruption to homeostasis</b>	<b>Both affect the body's ability to perform aerobic respiration (1)</b>	
	Body unable to produce/respond to insulin (1)	Low/lack of thyroxine (1) Decrease in metabolic rate (1)
<b>Causes</b>	<b>Both can be caused by autoimmune response/attack on body (1)</b>	
	Type II diabetes caused by poor lifestyle (1)	<u>Any one:</u> Lack of iodine (1) Removal of thyroid gland due to cancer/tumour (1)
<b>Symptoms</b>	<b>Both can result in feeling of fatigue (1)</b>	
	<u>Maximum of one:</u> Thirst Frequent urination Extreme hunger Unexplained weightloss	<u>Maximum of one:</u> Slow heart rate Unexplained weight gain Goitre
<b>Treatments</b>	<b>Both can be treated with synthetic hormones (1)</b>	
	<u>Maximum of one:</u> Insulin injections/pump (1) Improved lifestyle choices (1)	Iodine supplements (1)

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)**

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)

Arno would acquire natural passive immunity through antibodies being passed from the mother to the child	1 mark
And through the placenta	1 mark
And breast milk	1 mark
Immunity provided through the placenta will last until a few months/ 3 months after birth	1 mark
The major hit of antibodies through breast milk comes from colostrum which will wear off after a few months	1 mark
Ongoing breast milk confers a small number of antibodies while the baby is being breast fed	1 mark

- (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)

Any 9 of the following (or other reasonable answer):

<b>Social</b>	
Helps to create herd immunity/ social duty to protect the whole community	1 mark
Vaccination is in line with health advice given by medical professionals	1 mark
Peer groups influence the decision for or against vaccination	1 mark
Parents forget/ underestimate the value of vaccinations/ may have received misinformation about vaccines	1 mark
Previous negative experience/ side effects with vaccination/medical condition preventing ability to be vaccinated	1 mark
Ethical issues – testing on animals/culture in human/animal cells/tissue	
<b>Cultural</b>	
Cultural, religious and social context could influence vaccination uptake both for or against vaccination	1 mark
<b>Economic</b>	
May be difficult to get vaccine due to distance	1 mark
Tax bonuses for having vaccinations/increased social options for vaccination	1 mark
Reduced health care cost for treating those infected	1 mark
Cost of doctor/ vaccine/ cost to governments may prohibit vaccination	1 mark

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

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

(5 marks)

Artificial passive	1 mark
If a person is infected with a pathogen they have not been vaccinated against they may receive an injection of antibodies	1 mark
These are synthetically produced antibodies that are specific to the pathogen the person has been infected with	1 mark
These antibodies can disable the pathogen stopping the person from becoming ill	1 mark
The body hasn't undergone an immune response or created memory cells and may be vulnerable to subsequent infections	1 mark



**Question 41**

**(20 marks)**

Pedro was cooking dinner for his family. He accidentally 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)

The heat of the pan is detected by	1 mark
Thermoreceptors/ touch receptors/ pain receptors in the skin	1 mark
The information is sent along sensory neural pathways	1 mark
Along the arm to the spinal cord	1 mark
The information is passed along to an interneuron/ association neurone/ relay neuron in the spinal cord	1 mark
The interneuron/ association neurone/ relay neuron passes information around the spinal cord to a motor neuron	1 mark
The motor neuron sends a signal to the hand	1 mark
To move the hand/drop the pan quickly/ to minimise damage/ before the pain is felt	1 mark
The interneuron/ association neurone/ relay neuron also sends the impulse up the spinal cord to the brain	1 mark
The brain registers the impulse as pain	1 mark

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)

The pain receptors in the skin would be stimulated because of the burn	1 mark
Passing pain impulses to the brain which would register the impulse as painful	1 mark
If an ointment blocks these receptors no messages will be sent to the brain	1 mark
And no pain would be felt	1 mark

(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)

Mast cells are triggered to release histamine	1 mark
This causes vasodilation/ increased blood flow/increased permeability of blood vessels	1 mark
Heparin is released preventing clotting in the immediate area	1 mark
Causes heat/redness/swelling	1 mark
Cytokines/Chemokines/other substances released from mast cells attracts phagocytes to the area	1 mark
Phagocytes consume pathogens and debris	1 mark

**End of Questions**











Question number(s): .....

Lined writing area consisting of 26 horizontal lines.







*Spare grid*

