



# KINGSWAY CHRISTIAN COLLEGE

## Semester 1, 2021 Exam

### Year 12 ATAR Human Biology

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

Teacher: Dr S Yap

Class: \_\_\_\_\_

#### 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	6	6	90	106	50
Section Three Extended answer	3	2	50	40	20
<b>Total</b>					100

## Instructions to candidates

- The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2021. Part II Examinations*. Sitting this examination implies that you agree to abide by these rules.
- Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
- 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 three questions. You must answer two questions. Tick the box next to the question you are answering. Write your answers in this Question/Answer booklet.

- 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.
- Supplementary pages for planning/continuing your answer 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.

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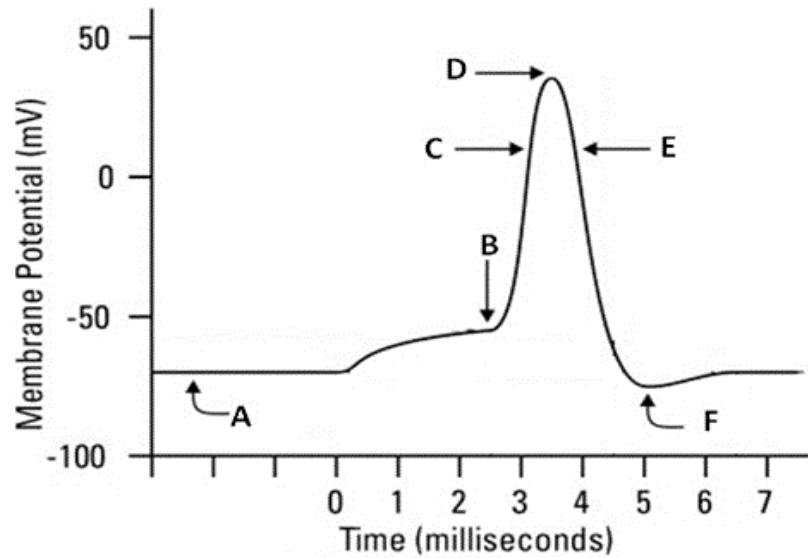
1. Antiviral medication
  - (a) interrupts the replication process of viruses.
  - (b) encourages the activity of T cells.
  - (c) can be used to inhibit the action of enzymes in bacteria.
  - (d) encourages macrophages to engulf viruses.
  
2. Calcium and phosphate levels in the blood are controlled by hormones secreted by the
  - (a) adrenal glands.
  - (b) parathyroid glands.
  - (c) ovaries.
  - (d) pancreas.
  
3. Which of the following is not a sympathetic effect on the body?
  - (a) pupil dilation
  - (b) constriction of muscle walls of the bladder
  - (c) glycogenolysis
  - (d) decreased activity in the digestive system
  
4. Endocrine glands involved in the homeostatic control of temperature include
  - (a) the pancreas, thyroid gland and the hypothalamus.
  - (b) the thyroid gland, parathyroid glands and the anterior pituitary gland.
  - (c) the adrenal glands, pancreas and the anterior pituitary gland.
  - (d) the thyroid gland, adrenal glands and the hypothalamus.
  
5. The main advantage of maintaining a constant body temperature is to
  - (a) enable enzymes to function optimally.
  - (b) reduce heat loss.
  - (c) reduce water loss through the skin.
  - (d) kill pathogens that enter the body.

6. Which of the following hormones is not secreted from the anterior pituitary gland?
- (a) LH
  - (b) Oxytocin
  - (c) ACTH
  - (d) Growth hormone
7. Endocrine organs are composed of
- (a) secretory cells and have ducts.
  - (b) nerve cells without ducts.
  - (c) tissue that secretes hormones into the blood.
  - (d) target cells surrounded by extracellular fluid.
8. Alzheimer's disease affects
- (a) the production of myelin in neurons of the CNS.
  - (b) the production of dopamine in the basal ganglia.
  - (c) the cerebellum and therefore coordinated movement.
  - (d) areas in the frontal lobe of the cerebrum.
9. Motor neurons in the peripheral nervous system are categorized by structure as
- (a) multipolar neurons with multiple dendrites.
  - (b) unipolar neurons with only one dendrite.
  - (c) multipolar neurons with multiple axons.
  - (d) bipolar neurons with at least two dendrites.
10. Susie suffers from diabetes mellitus Type 1. She must inject insulin to maintain blood glucose homeostasis. Occasionally her glucose levels decrease causing weakness and dizziness.

Which of the following could be the cause of a decrease in blood glucose?

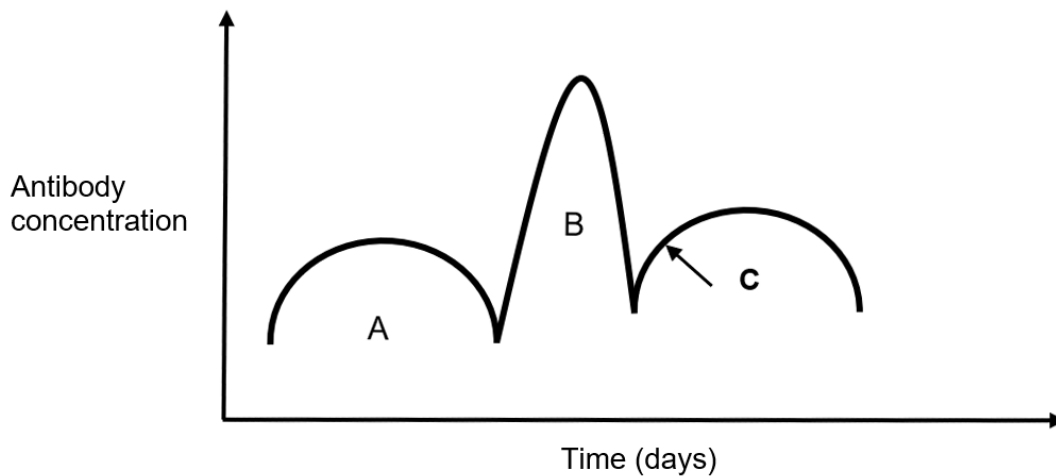
- I. Eating too much carbohydrate
  - II. Eating too little carbohydrate
  - III. Injecting too much insulin
  - IV. Injecting too little insulin
  - V. Too much exercise
  - VI. Too little exercise
- (a) I, III and V
  - (b) I, IV and VI
  - (c) II, III and V
  - (d) II, IV and VI

Questions 11, 12 and 13 refer to the diagram below.



11. At the point labelled B on the diagram above, which of the following is occurring?
- The threshold for depolarization is reached.
  - Sodium ion channels in the membrane open.
  - Potassium ion channels in the membrane open.
  - Sodium ion channels in the membrane close.
12. The refractory period occurs between points
- A and B.
  - B and F.
  - B and D.
  - A and F.
13. Point D on the diagram represents
- depolarisation.
  - hyperpolarisation.
  - polarisation.
  - resting membrane potential.

Questions 14 and 15 refer to the following graph depicting the production of antibodies following an infection.



14. During the period indicated by arrow C
- antibodies are being produced by T cells due to a new infection.
  - antibodies are being produced by memory cells in response to the original infection.
  - passive natural immunity is occurring against a new infection.
  - antibodies are being produced by plasma cells in response to a new infection.
15. The curve shown as B is a
- secondary response involving T cells engulfing the original antigen.
  - response to a different antigen and plasma cells recognising it.
  - response to using specific antibiotics to treat the infection.
  - secondary response involving memory cells recognising the original antigen.
16. Which of the following statements about Diabetes Type 2 is correct?
- It can be treated easily with vitamin and mineral supplements.
  - The risk factors include smoking and lack of physical activity.
  - The only treatment is insulin injections.
  - It is caused by an autoimmune condition.
17. Herd immunity is important because it
- results in all people in the population being immune to a disease.
  - means that entire populations are vaccinated against specific diseases.
  - results in less chance of a disease being transmitted between people.
  - means that people can travel overseas without risk of contracting disease.

18. Reabsorption of salt in the kidney is regulated by a hormone secreted by the
- (a) anterior pituitary gland.
  - (b) hypothalamus.
  - (c) posterior pituitary gland.
  - (d) adrenal gland.
19. Patterns of sleeping and waking are controlled by the
- (a) cerebrum.
  - (b) cerebellum.
  - (c) hypothalamus.
  - (d) medulla oblongata.
20. Synthetic hormones, such as insulin, can be manufactured by using technology such as recombinant DNA. This process involves
- (a) the use of vectors to introduce the desired DNA into host cells.
  - (b) the use of viruses to manufacture large quantities of hormone.
  - (c) the use of gene therapy to isolate the required gene for cloning.
  - (d) the manufacture of large quantities of normal pancreatic cells.
21. Recombinant DNA technology uses restriction enzymes to
- (a) catalyse reactions within the host cell.
  - (b) cut DNA at recognition sites.
  - (c) join pieces of DNA in a plasmid.
  - (d) introduce healthy DNA into host cells.
22. Receptors that detect changes in water concentrations in the body are called
- (a) thermoreceptors.
  - (b) osmoreceptors.
  - (c) pain receptors.
  - (d) chemoreceptors.

Questions 23, 24 and 25 refer to the information and table below.

A researcher was interested to find out if the amount of caffeine consumed per day affected blood pressure in adults. He asked for volunteers and 40 participants signed up for the investigation. They were allocated to four groups of ten and their baseline blood pressure was recorded before they consumed cups of coffee. Group A consumed one cup of caffeinated coffee during a 3-hour period. Group B consumed three cups of caffeinated coffee during a 3-hour period and Group C consumed six cups of caffeinated coffee during a 3-hour period. Group D consumed three cups of decaffeinated coffee during a 3-hour period. All participants were asked to sit and relax in a room that was supervised by the researcher.

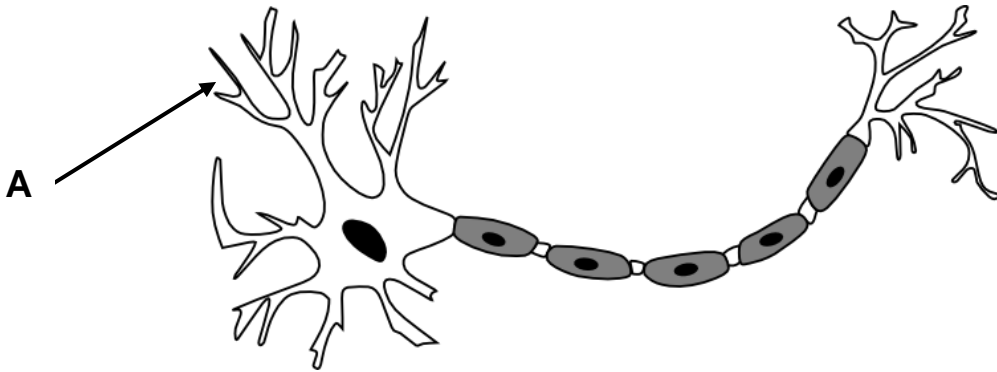
The results are shown below.

Group	Average baseline blood pressure (mmHg)	Average blood pressure following consumption of coffee (mmHg)
A	120/72	121/74
B	118/68	127/80
C	122/74	138/88
D	123/76	123/72

23. From the data in the table, which group had the greatest increase in blood pressure following the consumption of caffeine?
- (a) A
  - (b) B
  - (c) C
  - (d) D
24. One of the problems with the validity of this investigation is that
- (a) how the participants relaxed was not considered.
  - (b) the concentration of the caffeine was not measured accurately.
  - (c) the groups were too small.
  - (d) it was not ethical as the participants did not sign consent forms.
25. Which of the following should have been considered to ensure that the investigation results were reliable?
- (a) The temperature of the room should have been controlled.
  - (b) The weight of each participant should have been considered.
  - (c) The sample size should have been greater and more tests conducted.
  - (d) The initial blood pressure should have been the same for all volunteers.



Questions 26 and 27 refer to the diagram below.



26. The neuron shown above is located in the
- efferent division of the peripheral nervous system.
  - afferent division of the peripheral nervous system.
  - afferent division of the central nervous system.
  - efferent division of the central nervous system.
27. Structure A
- controls the function of the neuron.
  - increases the speed of transmission of impulses.
  - is only found in motor neurons.
  - conducts impulses from other neurons to the cell body.
28. The thirst reflex is triggered by water loss from body fluids and results in
- the secretion of ADH and reabsorption of water in the nephron.
  - the thirst centre in the hypothalamus to stimulate conscious fluid intake.
  - the thirst centre in the medulla to stimulate conscious fluid intake.
  - the secretion of aldosterone and reabsorption of water in the nephron.
29. In cold conditions, a decrease in heat loss occurs when
- shivering occurs.
  - there is an increase in physical activity.
  - there is a reduction in sweating.
  - metabolic rate increases due to hormonal activity.
30. The skin has many functions that assist with the maintenance of homeostasis. Which of the following is correct?
- Skin contains receptors that detect fluid balance and pain.
  - Skin produces hormones that prevent damage from UV radiation.
  - Skin is covered in hairs that play a role in defence against disease.
  - Skin is involved in thermoregulation and defence against disease.

**End of Section One**

**Section Two: Short answer**

**50% (106 Marks)**

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

Supplementary pages for planning/continuing your answer 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.

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**Question 31**

**(16 marks)**

Hypothyroidism is caused by inadequate secretions from the thyroid gland. This results in symptoms including decreased heart rate, fatigue and intolerance to cold.

- (a) Name the hormone secreted by the thyroid gland. (1 mark)

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- (b) State **two** possible causes of hypothyroidism. (2 marks)

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Doctors usually conduct a blood test to check for thyroid function. They measure the concentration of TSH in the blood of the patient.

- (c) Use a steady state control model to help explain why the concentrations of TSH are measured. (7 marks)

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- (d) Explain why the sufferer would experience intolerance to cold. (2 marks)

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- (e) Outline the production of recombinant thyroid stimulating hormone. (4 marks)

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When Joni returned home she felt ill and started to hyperventilate. She almost collapsed and stopped breathing. Fortunately, her father realised what was happening and he made her breathe into a paper bag. Her breathing slowed and she started to feel better.

- (c) Use a steady state model to explain why Joni almost stopped breathing. (6 marks)

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- (d) Explain how breathing into a bag would have helped to cause her breathing to return to normal. (4 marks)

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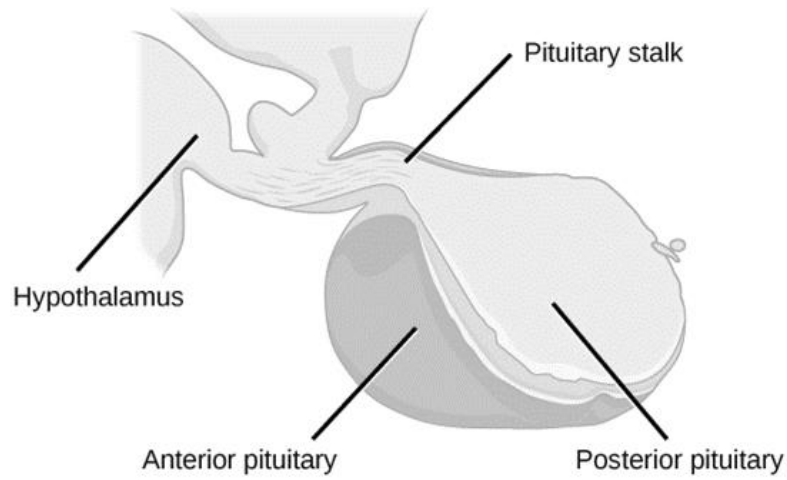
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Question 33

(18 marks)

The hypothalamus is located at the base of the brain and regulates many body functions. Many hypothalamic functions are carried out through the pituitary gland. The structural relationship between the hypothalamus and pituitary gland is depicted in the diagram below.



- (a) Describe the structural and functional relationship between the hypothalamus and the anterior pituitary gland. (3 marks)

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- (b) Explain why the posterior pituitary gland is not considered to be a true endocrine gland. (4 marks)

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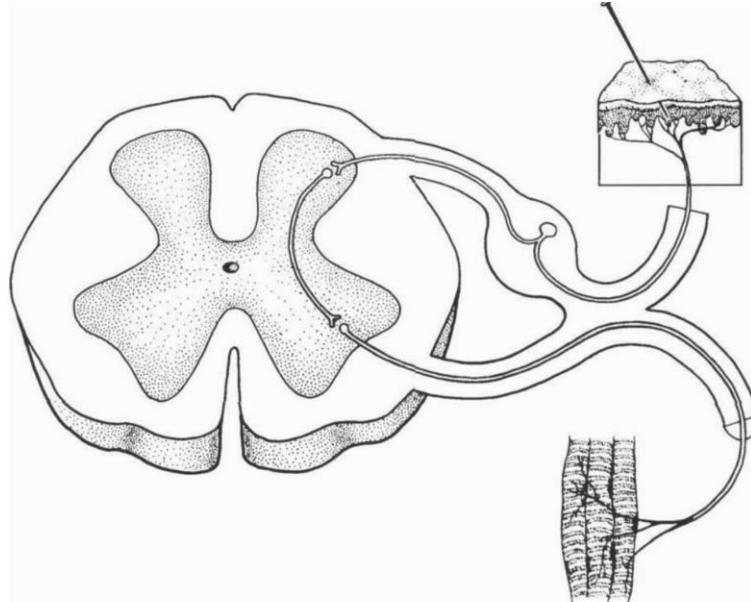


Question 34

(12 marks)

Lorraine was sewing a quilt for her new granddaughter. While she was pinning some fabric, she pricked her finger and rapidly pulled her finger away from the sharp end of the pin. Her reaction was due to a simple reflex arc.

A simple reflex arc is shown below.



- (a) On the diagram above correctly label the sensory, relay and motor neurons. (3 marks)
- (b) State the **four** properties that all reflexes possess. (4 marks)

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- (c) Explain why Lorraine pulled her finger away before she felt any pain. (3 marks)

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- (d) The grey matter in the spinal cord contains many nerve cell bodies. State the other location of nerve cell bodies in the diagram and name the structure formed by the collection of the cell bodies. (2 marks)

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(iv) List three ethical principles that must be adhered to while carrying out clinical trials. (3 marks)

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(v) Some people are reluctant to receive vaccinations despite the benefit they provide. Provide one social and one cultural reason why someone may be reluctant to receive the Novavax vaccine. (2 marks)

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## Question 36

(19 marks)

A researcher wanted to investigate whether or not a popular natural formulation of Olive Leaf Extract successfully prevented colds and flu, as described in the marketing research. To test this, 10 000 volunteers were divided into three groups. The experimental group A were administered a dose of 500 mg of the extract in a capsule every morning for one year. Experimental group B were administered a dose of 1000 mg of the extract in a capsule every morning for one year. The control group received a placebo also administered every morning for one year. The researcher collected data from the volunteers and calculated the percentage of people who developed colds or flu during the year.

The results are displayed in the table below.

Group	Percentage who developed colds or flu
500 mg Olive Leaf Extract	22
1000 mg Olive Leaf Extract	17
Placebo	31

- (a) Write a hypothesis for this investigation. (2 marks)

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- (b) Other than age and gender, identify **three** variables that should have been controlled in this investigation. (3 marks)

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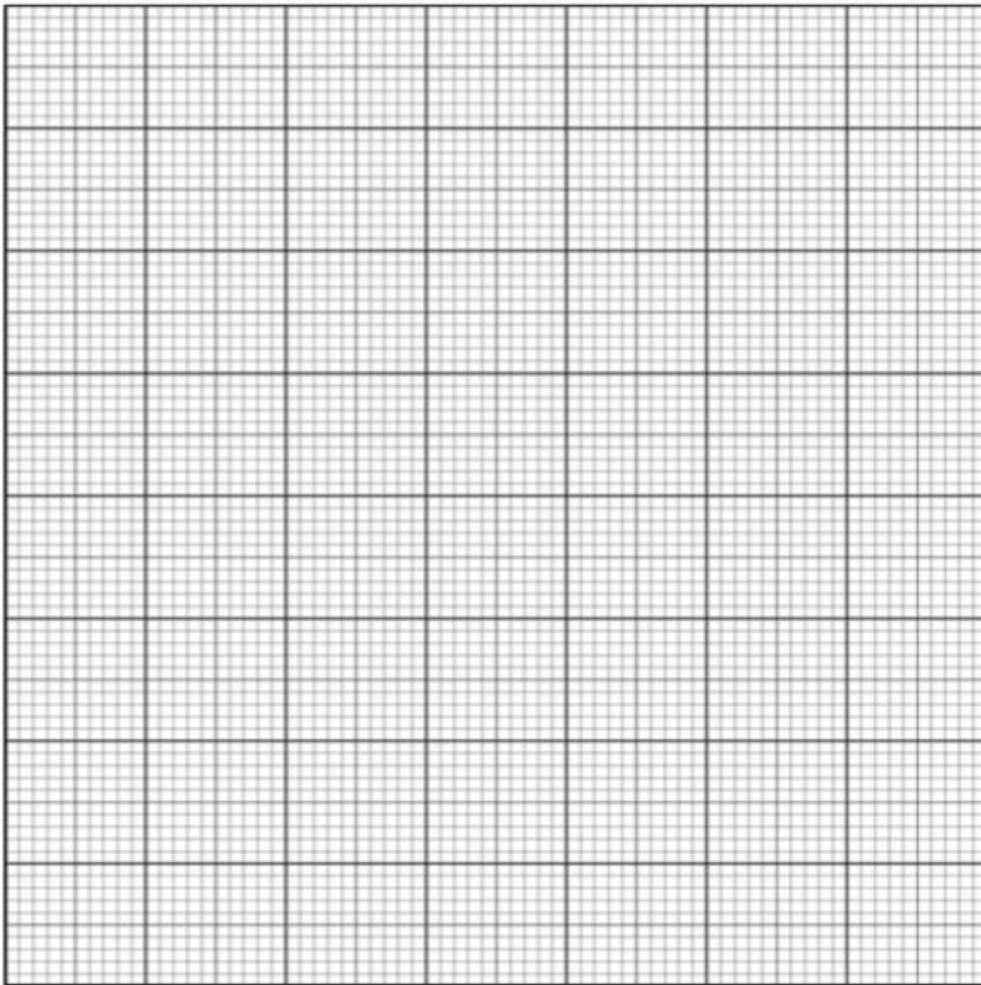
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(c) Graph the data from the table on the grid below.

(5 marks)



A spare grid is provided at the end of this Question/Answer Booklet. If you need to use it, cross out this attempt and indicate that you have redrawn it on the spare grid.

**Question 36** (continued)

- (d) Define the term 'placebo' and describe the ideal composition of the placebo in this study. (3 marks)

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- (e) Describe **two** possible sources of error in this investigation. (2 marks)

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- (f) State the conclusion for the experiment based on the results. (3 marks)

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- (g) State **one** way that reliability could have been improved for this investigation. (1 mark)

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**End of Section Two**

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

This section contains **four** questions. You must answer **two** questions.  
Answer **one** question from 37 and 38 and **one** question from 39 and 40.

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 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: 50 minutes.

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

**Question 37****(20 marks)**

The nervous system and endocrine systems coordinate all of the body's voluntary and involuntary actions.

- (a) Name the divisions of the nervous system and describe the relationships between them. (10 marks)

Nerves communicate with each other and effector muscles and organs using neurotransmitters.

- (b) Describe, in detail, the processes that occur as an impulse is transmitted from the axon of one neuron to the dendrite of another. (10 marks)

**Question 38****(20 marks)**

On 23 October 2019, the bodies of 39 Vietnamese people—29 men, 2 boys, and 8 women—were found in the trailer of an articulated refrigerator lorry in Grays, Essex, United Kingdom. The container in which they were smuggled across the border was tightly sealed and the victims died of asphyxia, due to lack of oxygen, and hyperthermia. The 39 people, being crammed into a relatively small space, caused an increase in the air temperature to 38.5°C and an increase in the concentration of carbon dioxide.

- (a) Explain the reasons for the increase in air temperature in the container and the increase in carbon dioxide concentration. (4 marks)
- (b) Explain how a person's body would respond to these conditions in an attempt to regulate body temperature. (11 marks)

Given that the people realised the danger they were in, their bodies would have responded to their frightening situation.

- (c) State which division of the nervous system would have responded in this situation and describe **four** physiological effects that would have resulted. (5 marks)



**Question 39****(20 marks)**

The COVID-19 pandemic has caused the infection and death of millions of people throughout the world. The virus affected people in every country throughout the world and health experts advised that the key to preventing its spread was social distancing, wearing masks and hygiene, particularly hand sanitizing.

- (a) Describe **five** non-specific external defences that prevent pathogens from entering and invading the body tissues. (10 marks)
- (b) Explain the reasons for the need for people to socially distance, wear masks and maintain hand hygiene. (10 marks)

**Question 40****(20 marks)**

There are four (4) main ways that we can gain immunity.

- (a) Compare and contrast the 4 types of immunity. Provide examples for how each may be gained. (14 marks)
- (b) Outline the role of T lymphocytes in specific immunity. (6 marks)

**End of Questions**































Spare grid

