KINGSWAY CHRISTIAN COLLEGE

Semester 1, 2020 Exam

YEAR 12 ATAR HUMAN BIOLOGY

Student Name: _____Teacher: _____

TIME ALLOWED FOR THIS PAPER

Reading time before commencing work: Ten minutes

Working time for the paper: Three Hours

MATERIALS REQUIRED/RECOMMENDED FOR THIS PAPER

To be provided by the supervisor:

- This Question/Answer Booklet
- Multiple Choice Answer Sheet

To be provided by the candidate:

- Standard items: Pens, pencils, eraser or correction fluid, ruler, highlighter, ruler.
- Special items: Calculators satisfying the conditions set by the Schools Curriculum and standards authority for this subject.

IMPORTANT NOTE TO CANDIDATES

- No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Structure of this paper

Section	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	8	8	90	100	50
Section Three Extended answers	3	2	50	40	20
				Total	100

Instructions to candidates

1. The rules for the conduct of the Western Australian examinations are detailed in the *Year 12 Information Handbook 2020*. 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 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.

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.

1. Which of the following is an example of artificial active immunity?

   (a) vaccinations
   (b) being injected with antibodies
   (c) contracting the disease
   (d) antibodies passed through the placenta

2. Osmotic pressure is determined by osmoreceptors. Where in the body would you find osmoreceptors?

   (a) medulla oblongata
   (b) hypothalamus
   (c) anterior pituitary
   (d) the skin

3. The descending tracts contained in the white matter of the spinal cord

   (a) carry sensory information to the brain.
   (b) conduct nerve impulses down the spinal cord to lower motor neurons.
   (c) contain motor axons to carry nerve impulses away from the peripheral nervous system.
   (d) carry sensory information away from the brain.

4. Which of the following is an **accurate** comparison of lipid-soluble and water-soluble hormones?

   (a) water-soluble hormones are long acting and lipid-soluble hormones are short acting
   (b) water-soluble hormones do not require a secondary messenger and lipid-soluble hormones do
   (c) water-soluble hormones include cortisol and lipid-soluble hormones include insulin
   (d) water-soluble hormones bind to receptors on the cell membrane and lipid-soluble hormones diffuse through the cell membrane

SEE NEXT PAGE

5. A Human Biology student was doing an experiment to measure to what extent energy drinks improve physical performance. Her hypothesis was 'If a student consumes a can of energy drink immediately before running 100m they will record a faster time than without consuming the energy drink'. The student made sure to repeat her experiment three times for each participant. She did this to ensure the experiment was

   (a) reliable.
   (b) valid.
   (c) accurate.
   (d) controllable.

6. The part of the brain responsible for the autonomic regulation of hydrogen ion concentration in blood is the

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

7. Which endocrine organ produces growth hormone (GH) and adrenocorticotrophic hormone (ACTH)?

   (a) ovaries
   (b) adrenal cortex
   (c) anterior pituitary
   (d) pancreas

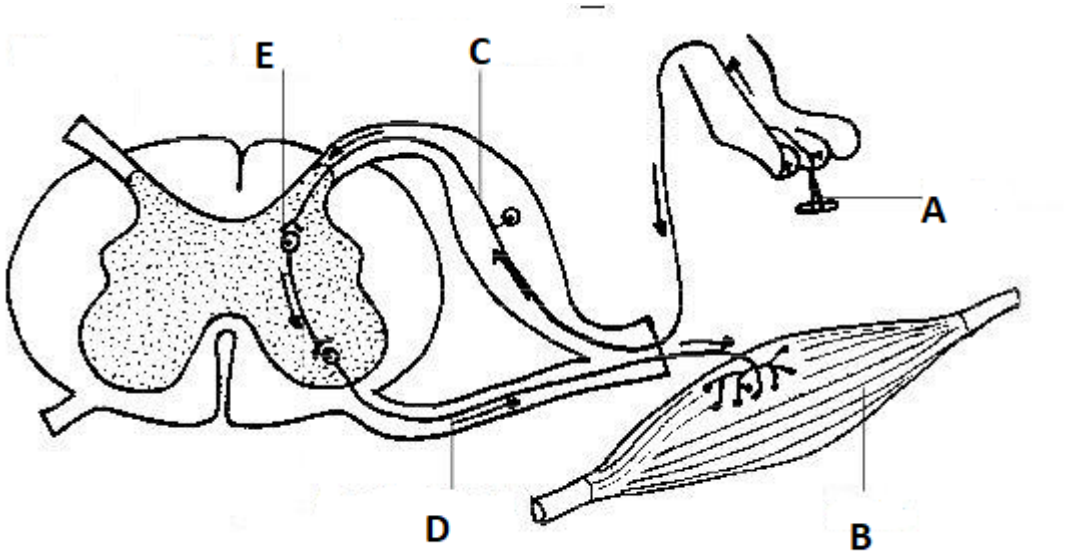
8. A person suffering from weight gain, fatigue and lack of tolerance to cold has been prescribed medication from their doctor. They are **most** likely to be suffering from

   (a) hypothyroidism.
   (b) hyperthyroidism.
   (c) type I diabetes.
   (d) type II diabetes

9. Which of the following would be a **correct** definition of negative feedback?

   (a) when the body returns to normal
   (b) when the original stimulus is intensified
   (c) when the original stimulus is reversed
   (d) when the original stimulus cannot be reversed

Questions 10 -12 refer to the diagram below.



10. The structure labelled ‘D’ could be described as

(a) a sensory neuron carrying information towards form the stimulus to the CNS.
(b) a motor neuron carrying information to the effector.
(c) an interneuron transferring information from the sensory neuron to the motor neuron.
(d) a muscle fibre receiving an impulse and carrying out an effect.

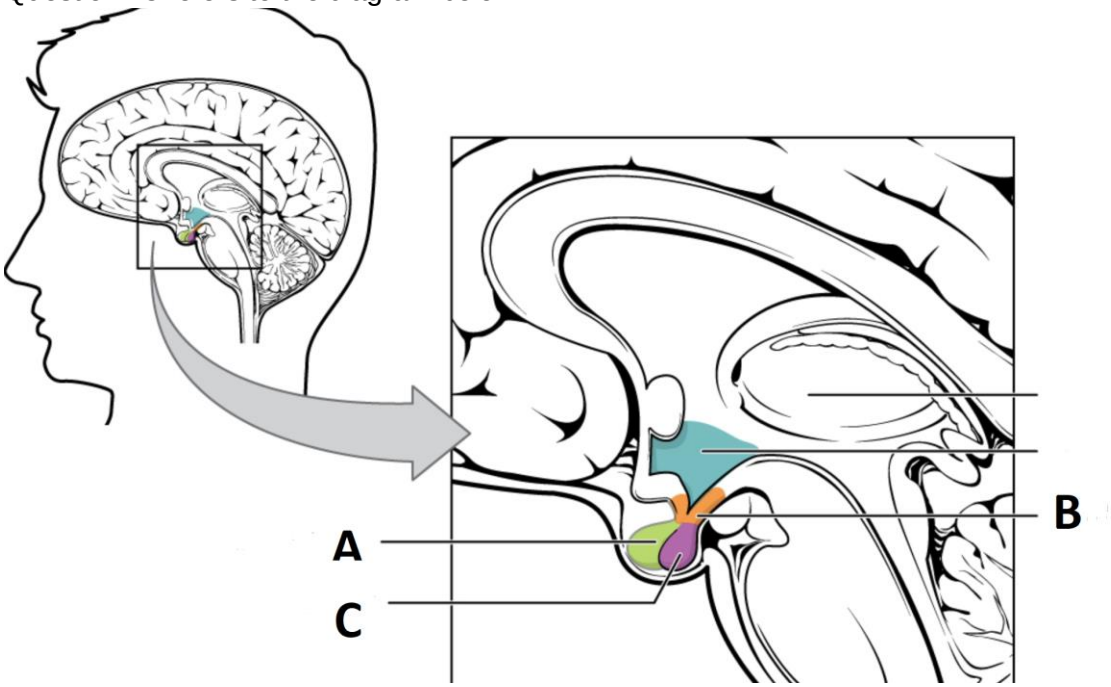
11. The structure labelled ‘E’ could be described as

(a) a sensory neuron carrying information towards form the stimulus to the CNS.
(b) a motor neuron carrying information to the effector.
(c) an interneuron transferring information from the sensory neuron to the motor neuron.
(d) a muscle fibre receiving an impulse and carrying out an effect.

12. What type of stimulus receptor would be found at ‘A’?

(a) thermoreceptor
(b) chemoreceptor
(c) osmoreceptor
(d) pain receptor

Question 13 refers to the diagram below.



13. Which of the following are labelled **correctly**?

    (a) A= Infundibulum, B= Anterior Pituitary, C= Posterior Pituitary
    (b) A= Anterior Pituitary, B= Hypothalamus, C= Posterior Pituitary
    (c) A= Posterior Pituitary, B= Hypothalamus, C= Anterior Pituitary
    (d) A= Anterior Pituitary, B= Infundibulum, C= Posterior Pituitary

14. The flushing action of acidic urine prevents infection in the urethra. This is an example of

    (a) specific, internal defence
    (b) specific, external defence
    (c) non-specific, internal defence
    (d) non-specific, external defence

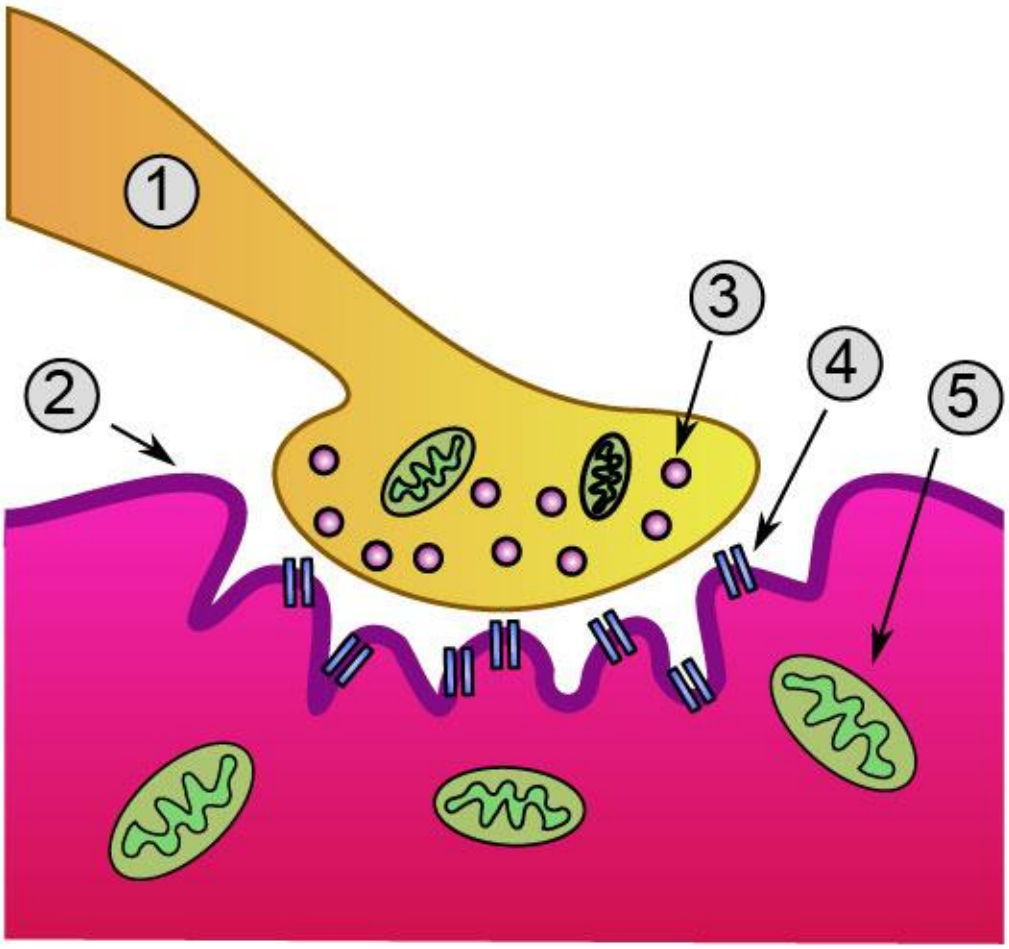
15. A disease has been discovered on the south coast of Western Australia. The disease causes people infected to have high fevers and hallucinations. The outbreak began when sufferers consumed infected food from a single petrol station. The mode of transmission for this pathogen is likely to be

    (a) direct and indirect contact
    (b) transfer of body fluids
    (c) disease specific vectors
    (d) contaminated food and water

16. On hot days, human beings lose a lot of fluid through sweat. This loss of water causes changes in the nephron to minimise the impact of sweating. Which of the following **best** describes this response?

    (a) ADH is released by the posterior pituitary causing an increase in the permeability of the collecting duct
    (b) ADH is released by the posterior pituitary causing a decrease in the permeability of the collecting duct
    (c) ADH is released by the adrenal medulla to increase basal cell metabolism
    (d) ADH is released by the adrenal medulla to decrease basal cell metabolism

Question 17 and 18 refer to the image shown below.



17. In the diagram where are the neurotransmitters located prior to nervous transmission?

    (a) 2
    (b) 3
    (c) 4
    (d) 5

18. What is the name of the structure labelled 4?

(a) mitochondrion
(b) receptor protein
(c) synapse
(d) axon terminal

19. Which of the following pairings of hormone and target organ is **incorrect**?

(a) hormone: follicle stimulating hormone (FSH); target organ: ovary
(b) hormone: glucagon; target organ: liver and fat
(c) hormone: parathyroid hormone; target organ: uterus
(d) hormone: oxytocin; target organ: uterus

20. Which is the **best** definition for an antibody?

(a) any substance capable of causing a specific immune response
(b) any organism that causes disease
(c) a substance produced in B-lymphocytes that binds to antigens
(d) a substance that is used in all vaccines

21. Which of the following describes the **correct** definition of agglutination by antibody action?

(a) make soluble substances insoluble
(b) coat pathogens so they can be consumed by phagocytes
(c) cause particles including the pathogen to clump together
(d) inhibit reactions of pathogens

22. The part of the brain most associated with the autonomic thirst reflex is?

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

23. For which of the following sets of data is a line graph **not** suitable?

(a) the average heart rate of a student before, during and after exercise
(b) the number of grandchildren of residents in a nursing home
(c) the total kilojoules consumed per day of an athlete
(d) the time taken for an enzyme to fully breakdown its substrate at different temperatures

24. Which of the following is **correct** in relation to the sympathetic and parasympathetic divisions of the autonomic nervous system?

	Sympathetic Division	**Parasympathetic Division**
(a)	causes an increase in sweating	causes a decrease in sweating
(b)	pupils constrict	pupils dilate
(c)	blood flow to skeletal muscles increases	blood flow to internal organs increases
(d)	heart rate decreases	heart rate increases

25. Which of the following is the name of cells that are part of the immune system that slow down the immune response when the pathogen has been eliminated?

(a) killer T-cells
(b) helper T-cells
(c) memory cells
(d) suppressor T-cells

26. A person with Hashimoto's disease was in a medical trial where they had to record the levels of thyroxine in their blood every morning before breakfast for 5 days. The results are

Day	1	2	3	4	5
Thyroxine level (ng/dL)	2.9	3.2	4.1	2.9	5.4

Calculate the mean blood level of thyroxine over the 5 days.

(a) 2.9 ng/dL
(b) 3.2 ng/dL
(c) 2.7 ng/dL
(d) 3.7 ng/dL

27. Which of the following is the **best** definition of hormone action by 'enzyme amplification'?

(a) the effect a hormone has by increasing the total numbers of a particular enzyme
(b) the reduction of activation energy for a chemical reaction to occur
(c) the effect an enzyme has in increasing the rate of reaction
(d) the rate of product formation in an enzyme reaction

SEE NEXT PAGE

28. When a nerve cell is at rest there is a potential difference across the cell membrane of -70mV. This difference in charge is caused by

    (a) the membrane continuously pumps positively charged potassium ions from the intracellular fluid to the extracellular fluid.
    (b) the intracellular fluid has more negatively charged ions than the extracellular fluid.
    (c) the extracellular fluid has more positive sodium ions than the intracellular fluid.
    (d) sodium ions which are positively charged are more concentrated in the intracellular fluid.

29. Which of the following comparisons describing the difference in functioning of the nervous system and endocrine system is **correct?**

	Nervous System	**Endocrine System**
(a)	Slow transmission	Rapid transmission
(b)	Short duration	Long lasting
(c)	Chemical signals	Electrochemical signals
(d)	Many target organs	Single target organs

30. A researcher was testing the hypothesis:

"The range of sound frequencies that a person can hear decreases with increasing age"

He selected a number of subjects, both male and female, of differing ages. A sound generator was used to expose the subjects to sounds of varying frequencies. The dependent variable in this experiment was the:

    (a) age of the subjects.
    (b) volume of the sound.
    (c) frequency of the sound.
    (d) frequency range detected by the subjects.

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

This section has **eight** 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 **(13 marks)**

An investigation was carried out to determine the effectiveness of a new medication "hypostop" for the prevention of hypertension in people over the age of 55.

Two groups of people were involved in the investigation who had moderate hypertension. Group 1 was treated with "hypostop" while Group 2 was given a placebo. All participants measured their blood pressure daily for two weeks prior to the trial and for the two weeks during the trial.

The average blood pressure in Group 1 for the two-week trial before starting the medication was 143/95. The average blood pressure for Group 2 over the same period was 147/93. For the two weeks while conducting the experiment Group 1 was 138/88 and Group 2 was 145/95.

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

_____

_____

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

_____

_____

(c) Why was a placebo used for Group 2 participants? (1 mark)

_____

_____

(d) State **three** variables that would need to be controlled to ensure a fair test. (3 marks)

The average blood pressure results for 9 of the Group 1 participants for the two-week medication trial were.

Participant	1	2	3	4	5	6	7	8	9
Average Blood pressure (mmHg) systolic / diastolic	140 / 90	135 / 85	134 / 82	150 / 100	130 / 80	127 / 80	125 / 85	135 / 85	128 / 90

(e) State the **median** blood pressure (arranged by systolic pressure). (1 mark)

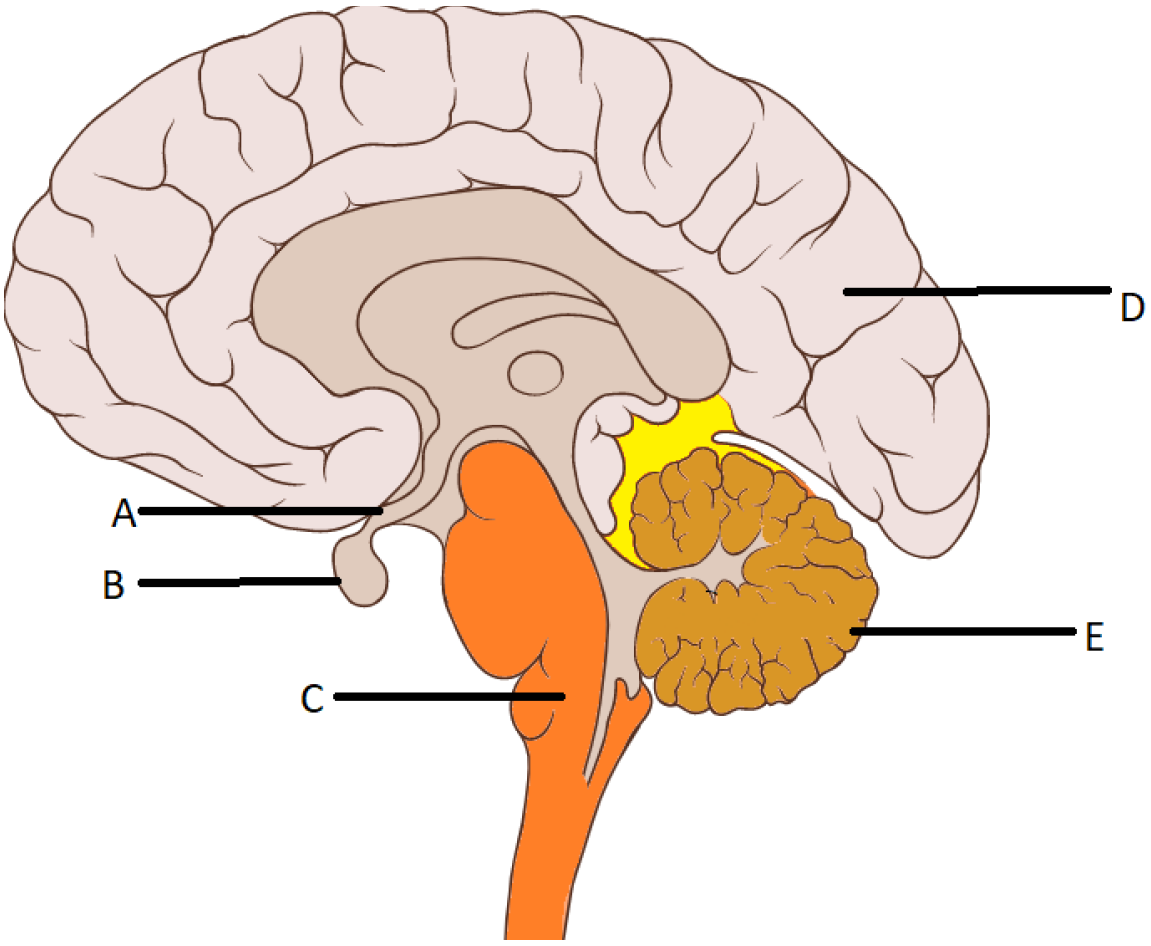
(f) State the **mode** score for this set of data. (1 mark)

(g) Suggest which participant could be considered an **outlier**. Explain the reason for your decision. (2 marks)

(h) What conclusion could be drawn based on the results of this study? (2 marks)

Question 32 **(16 marks)**

Use the diagram below to answer the following questions.



(a) Name the following structures. (2 marks)

A:_____

B:_____

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

C:_____

_____

_____

E:_____

_____

_____

(c) D, the cerebrum contains sulci and gyri. What is the difference between these two structures? (2 marks)

_____

_____

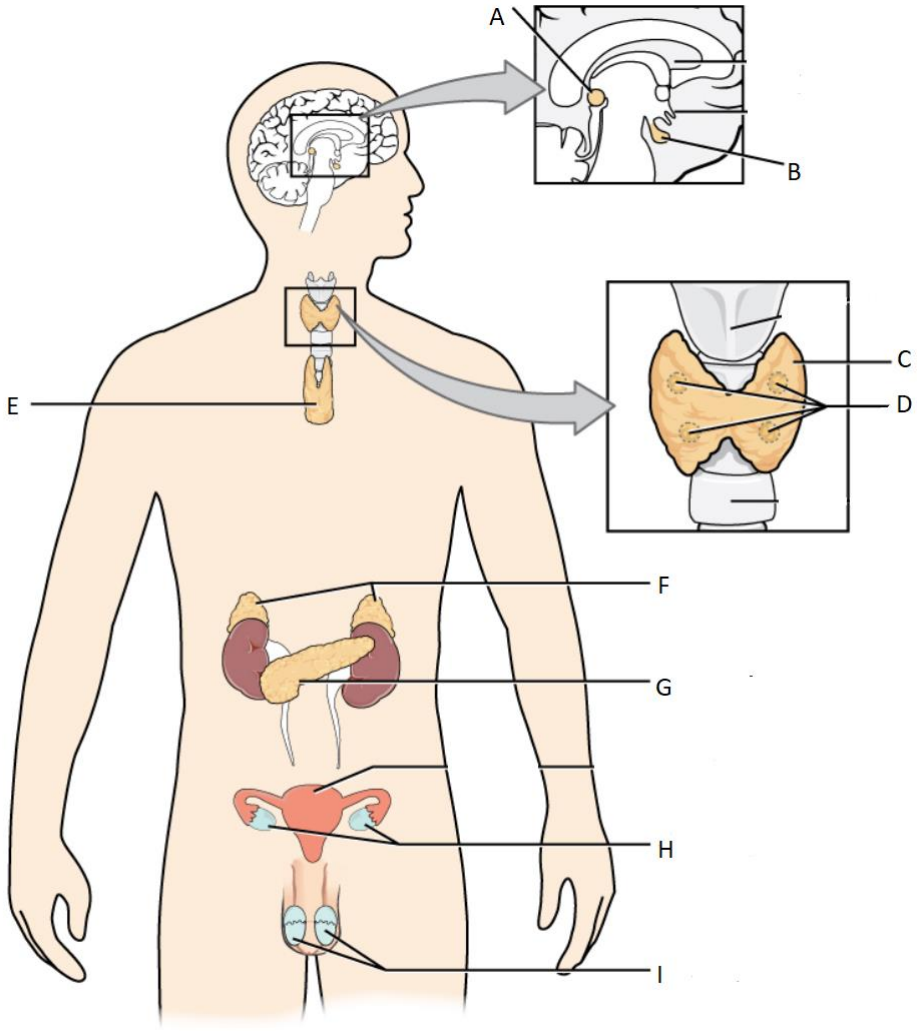
_____

(d) D, the cerebrum is divided into four lobes. Name each of these lobes and state a function of each? (8 marks)

Lobe	Function

Question 33 **(15 marks)**

The diagram below shows the glands of the endocrine system.



(a) Name the endocrine organ and give an example of **one** hormone it produces.
(6 marks)

C:_____

_____

H:_____

_____

I:_____

_____

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

Hormone	Target organ/s	Effect on the Body
Aldosterone		
Thyroid Stimulating Hormone		
Prolactin		

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

Growth Hormone:

_____

_____

_____

Parathyroid Hormone:

_____

_____

_____

Cortisol:

_____

_____

_____

Question 34 **(13 marks)**

(a) An elite swimmer measured the pH level of his blood prior to a race. It returned a reading 7.57. Immediately following the 50m freestyle event he measured his blood pH again, this time the result was 7.25.

i) What caused the pH level of the blood to drop, following the race? (2 marks)

ii) The drop in pH was detected by receptors and caused a change in breathing rate.

Describe the events that occurred in the body to cause the change in breathing rate.

(5 marks)

(b) Some of the swimmers have been known to hyperventilate immediately prior to a big race. State what impact this will have on the breathing response and give a reason why it is not advised.

(3 marks)

(c) Aside from increased breathing rate, what are **three** other physiological changes that occur in the body during and immediately after exercise to maintain blood pH as close to optimal?

(3 marks)

Question 35 **(9 marks)**

Many homeostatic mechanisms are regulated by the hypothalamus.

(a) Describe the processes leading to the secretion of hormones from the anterior lobe into the bloodstream. (3 marks)

_____

_____

_____

_____

_____

(b) Explain why the posterior lobe of the pituitary is not considered to be a true endocrine gland. (2 marks)

_____

_____

_____

(c) Cortisol production is indirectly dependent on the pituitary gland. If cortisol levels in the blood stream are too low how does the pituitary respond in order to increase cortisol production. (2 marks)

_____

_____

_____

(d) Name two other pairs of hormones where the release of a hormone from one endocrine organ triggers the release of a hormone from a different endocrine organ.

(2 marks)

_____

_____

_____

Question 36 **(13 marks)**

The flu season in 2019 was one of the worst in history with over 200000 people diagnosed with the flu and 430 deaths in Australia due to flu complications. Immunisation of the flu is recommended yearly and the most common type is a mixed vaccine that contains three strains of live-attenuated pathogen.

(a) What type of pathogen causes the flu and how is it transmitted from person to person? (2 marks)

(b) Outline steps the body goes through when administered with the flu vaccine so they will be protected from the infection over the flu season. (5 marks)

(c) Aside from receiving the flu vaccine, describe **three** things people can do to reduce their chance of catching this infection. (3 marks)

(d) State two reasons why people need to receive a new flu vaccine every year.

(2 marks)

_____

_____

_____

(e) If a person becomes infected with the flu, what type of medication could they take to reduce the severity of symptoms?

(1 mark)

_____

Question 37 **(11 marks)**

Cerebrospinal fluid (CSF) is a clear fluid that surrounds the brain and spinal cord. It contains mostly water, glucose, urea and some salts. One function of the CSF is to act as a shock absorber to protect the brain from any physical or mechanical damage.

(a) In addition to the function of the CSF in protecting the brain and spinal cord, name **two** other functions of this fluid. (2 marks)

_____

_____

_____

(b) Name two other structures that protect the brain from damage. (2 marks)

_____

_____

_____

(c) Daryl was an avid motorcyclist who lived in the far north of Western Australia and would sometimes forgo protective equipment, including his helmet, due to the extreme temperatures. One day he was riding his motorbike, fell and hit his head causing damage to his cerebellum.

Suggest **two** symptoms Daryl could have suffered after his accident that would have been caused by damage to the cerebellum.

(2 marks)

_____

_____

_____

_____

(d) When Daryl fell from his motorcycle he was riding with his friend Barry. Barry saw the accident and immediately stopped riding and ran to his friend to help. Daryl was trapped under his motorcycle in a ditch by the side of the road and despite Daryl and the motorcycle both being heavier than Barry he was able to pull Daryl from under the motorcycle and out of the ditch to perform CPR.

Describe the nervous signals that were sent between Barry's body and brain from the time he witnessed the accident to commencing CPR on his friend.

(5 marks)

Question 38 **(10 marks)**

An archaeologist, Freya is conducting a dig on an historical site in the middle of the Great Sandy Desert. Despite the extreme heat, her core body temperature remains the same due to the physiological responses of her body.

(a) Name **two** physiological changes the body makes to increase heat loss. In your answer describe how each change promotes heat loss.

(4 marks)

(b) Explain why working for a long time in the dry heat may result in heat exhaustion.

(3 marks)

(c) The mechanisms of fever are different to those of heat exhaustion. Describe the cause and purpose of a fever.

(3 marks)

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

This section contains **three** questions. You must answer **two (2)** questions. Write your answers on the pages following Question 41.

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 any **two** questions from Questions 39 to 41.

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

☐ **Question 39** **(20 marks)**

(a) Describe how a nerve impulse is propagated along an unmyelinated nerve fibre. Explain how a nerve impulse being propagated along a myelinated nerve fibre differs to an unmyelinated nerve fibre?

(10 marks)

(b) Contrast the autonomic and somatic divisions of the efferent peripheral nervous system

(5 marks)

(c) Describe the four properties that all reflexes share and give one example of a reflex that protects against pathogens.

(5 marks)

Question 40 **(20 marks)**

A person goes out for a celebratory breakfast and ingests orange juice, pancakes with syrup and hot chocolate. The high sugar content of this meal causes an immediate spike in blood sugar levels but are rapidly brought back down to a normal level.

(a) Describe the homeostatic mechanism that causes a decrease in high blood sugar levels in the minutes after the meal.

(10 marks)

(b) If this person suffered with undiagnosed type I diabetes, describe symptoms that would occur as the body attempts to remove excess sugar from the body.

(4 marks)

(c) Describe the differences between Type I and Type II diabetes, with regards to their cause, the age of onset and their treatment.

(6 marks)

Question 41 **(20 marks)**

Antibiotics are medications that are used to treat bacterial infections but are not effective against viral pathogens.

(a) Outline the reasons why antibiotics are ineffective against viral infections.

(3 marks)

(b) What is an antibiotic? In your answer name the two different types of antibiotic medications and describe how they work to combat a bacterial infection.

(7 marks)

(c) Vaccines can be used to provide immunity to a disease without ever becoming infected. Aside from live-attenuated vaccines name two different types of vaccines and describe their features.

(4 marks)

Rani was vaccinated against measles when she was an infant but her friend Martha was not. They both went on holiday and were contacted later about a measles outbreak on the plane on the way back to Perth. Martha became ill and contracted measles whereas Rani did not.

(d) Describe the difference between Rani and Martha's immune response to the measles pathogen when they were exposed on the plane.

(6 marks)

END OF QUESTIONS

Question number: _____

SEE NEXT PAGE

Question number: _____

Question number: _____

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Question number: _____

Question number: _____

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Question number: _____

Question number: _____

SEE NEXT PAGE

Additional Working

SEE NEXT PAGE

Additional Working

SEE NEXT PAGE

ACKNOWLEDGEMENTS

Question 10 Adapted from *File:Anatomy and physiology of animals A reflex arc az.jpg" by MrArifnajafov* retrieved 9 October, 2019 from https://search.creativecommons.org/photos/8a737b31-ed97-492c-8b68-75a5dd4a433f

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 32 Adapted from brain [image] retrieved 13 October, 2019 from https://commons.wikimedia.org/w/index.php?title=Special:Search&limit=20&offset=20&profile=default&search=brain+diagram&advancedSearch-current=%7B%7D&ns0=1&ns6=1&ns12=1&ns14=1&ns100=1&ns106=1&searchToken=5t1ghl6kj98mxf8r0brdfn6vr#%2Fmedia%2FFile%3ABrain_bulbar_region_as.svg

Question 33 Adapted from endocrine system [image] retrieved 11 March, 2019 from: https://sco.wikipedia.org/wiki/File:1801_The_Endocrine_System.jpg