TSSM
Creating VCE Success

THIS BOX IS FOR ILLUSTRATIVE PURPOSES ONLY

2012 Trial Examination

STUDENT NUMBER

									Letter
Figures									
Words									

BIOLOGY

Unit 3 - Written examination 1

Reading time: 15 minutes
Writing time: 1 hour and 30 minutes

QUESTION & ANSWER BOOK

Structure of book

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*	*Suggested times (minutes)*
A	25	25	25	20
B	7	7	50	70
			Total 75	90

- Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners and rulers
- Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.
- No calculator is permitted in this examination.

Materials supplied

- Question and answer book of 24 pages.

Instructions

- Print your name in the space provided on the top of this page.
- All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic communication devices into the examination room.

SECTION A – Multiple-choice questions

Instructions for Section A

Select the response that is **most correct** for the question. A correct answer scores 1, an incorrect answer scores 0. Marks are not deducted for incorrect answers. If more than 1 answer is completed for any question, no mark will be given.

Question 1

Radioactive elements can be used to trace the pathway of chemical reactions that take place within cells. If a scientist wished to trace the pathway of a newly synthesised protein, which of the following would be the best radioactive element to use?

A. Carbon

B. Hydrogen

C. Nitrogen

D. Sulphur

Question 2

Spider webs are mostly made up of the proteins fibroin and sericin. The fibres in spider webs are more than 5 times as strong as steel and much stronger than Kevlar which is used in bullet proof jackets.

Which of the following is the most likely explanation of the cause of the strength of spider webs?

A. There are many amino acids in the primary structure of spider web proteins

B. There are many beta sheets in the secondary structure of spider web proteins

C. There are many active sites in the tertiary structure of spider web proteins

D. Spider webs are a composite protein containing many different types of protein in the quaternary structure

Question 3

A single strand of DNA has the following sequence: TAGAAACGCTACGTG

The sequence of the complementary strand would be:

A. TAGAAACGCTACGTG

B. AUCUUUGCGAUGCAC

C. ATCTTTGCGATGCAC

D. ATCTTGCGATGCAC

SECTION A - continued

Question 4

The concentration of a solute in the cytoplasm of a cell was found to be 0.01%. The cell was placed into a solution that caused it to swell and burst. The most likely concentration of solute in the solution would be:

A. 0.001%

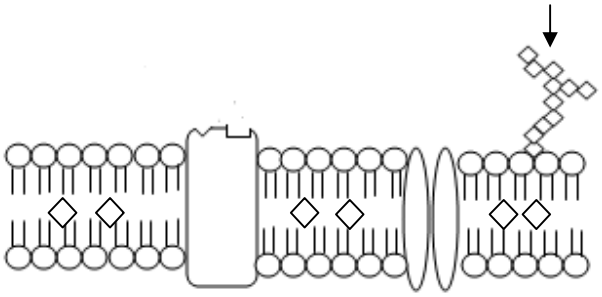
B. 0.01%

C. 0.02%

D. 0.1%

Question 5

The diagram below represents a plasma membrane.



The structure indicated with an arrow:

A. Is a contractile protein

B. Is a globular protein

C. Is a glycolipid

D. Is a carrier protein

Question 6

A reaction that is normally catalysed by a human enzyme was carried out at 30ºC. If there is an excess of substrate present, which of the following conditions would cause the greatest increase in the reaction rate?

A. Adding additional substrate and lowering the temperature to 20ºC

B. Adding additional substrate and raising the temperature to 35ºC

C. Adding additional enzyme and lowering the temperature to 20ºC

D. Adding additional enzyme and raising the temperature to 35ºC

Question 7
A student conducts an experiment in which they add increasing amounts of substrate into a solution containing an enzyme. They measure the reaction rate at several points and then graph the results. Which of the following best describes the results seen on their graph?

A. The graph is a straight line with the reaction rate being directly proportional to the substrate concentration.
B. The reaction rate increases as substrate concentration increases, up until a point after which it remains constant
C. The reaction rate remains constant throughout the experiment as the reaction rate is independent of substrate concentration.
D. The graph is shaped like a bell curve because increasing the amount of enzyme causes the substrate to be used up.

Question 8
Which of the following statements regarding the energy yield from the complete aerobic breakdown of a single molecule of glucose is most correct?

A. The yield will be lower than that of fermentation
B. The yield will be equivalent to that of anaerobic respiration
C. The yield will increase if additional oxygen is supplied
D. The yield will vary depending upon the supply of NADH to the mitochondria

Question 9
Upon testing a drug was found to create small holes in both of the membranes of the mitochondria. Which of the following concerns would be most likely to prevent the release of the drug for human use?

A. Glycolysis will be inhibited
B. ATP production will cease
C. There will be an overproduction of metabolic water
D. Oxidative phosphorylation will be inhibited

Question 10
When oxygen is not present in an animal cell the effect on cellular respiration will be that:

A. Pyruvate is converted into ethanol
B. ATP is still produced by the Kreb's cycle
C. Pyruvate is converted into lactic acid
D. Carbon dioxide accumulates

Question 11
During the hottest part of the day the leaves on a plant in bright sunlight wilted. The plant subsequently recovered. The rate of photosynthesis decreased during the time the leaves were wilted because:

A. Less carbon dioxide is able to enter the leaves

B. Less light is able to reach the leaves

C. Oxygen concentration has decreased inside the leaves

D. The surface area of the leaves decreased

Question 12
Identify the two energy carrying molecules that are produced during the light dependent stage of photosynthesis?

A. NADP and NADPH

B. ADP and ATP

C. ADP and NADP

D. NADPH and ATP

Question 13
Which of the processes in photosynthesis requires carbon dioxide?

A. Photolysis of water

B. The Krebs cycle

C. Production of ATP

D. Light independent reactions

Use the following information to answer Questions 14 and 15

Four identical plants were each sealed into a transparent box for a period of 12 hours. During this time they were placed under an artificial light. Apart from the colour of the box all other conditions were identical.

The colours of the box were:

Box 1: Colourless
Box 2: Red
Box 3: Green
Box 4: Yellow

Question 14

Which of the following is a correct interpretation of the information supplied?

A. The colour of the box is a controlled variable

B. The colour of the box is the independent variable

C. The amount of carbon dioxide produced is a controlled variable

D. The amount of oxygen produced is the outcome variable

Question 15

The concentration of carbon dioxide was measured at the beginning and the end of the experiment. It would be expected that at the end of the experiment the concentration of carbon dioxide would be highest in:

A. Box 1

B. Box 2

C. Box 3

D. Box 4

Question 16

The diagram below represents a control system associated with the human body.

Which of the following combinations of A, B and C is correct?

	A	B	C
A.	Receptor	Effector	Response
B.	Impulse	Receptor	Effector
C.	Effector	Receptor	Response
D.	Impulse	Response	Effector

SECTION A - continued

Question 17

When an action potential begins, sodium channels open which allows sodium ions to cross the membrane of the axon. What effect will this have on the polarity of the membrane?

A. There will be no difference between the inside and outside of the membrane.

B. Polarisation occurs

C. Depolarisation occurs

D. Repolarisation occurs

Question 18

Which of the following is an example of positive feedback?

A. Insulin is secreted when blood sugar levels increase

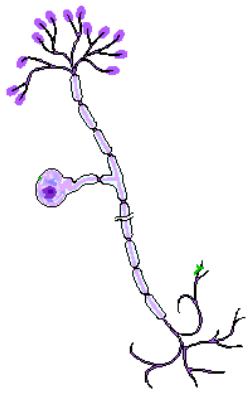
B. Vasoconstriction occurs when core temperature decreases

C. Contractions increase during child birth

D. Amylase is secreted when carbohydrates are consumed

Question 19

The diagram below shows a neuron. Which of the following statements regarding this neuron is correct?



A. The myelin sheath indicates this must be a motor neuron

B. The lateral cell body indicates this must be a sensory neuron

C. The dendrites indicate this must be an inter neuron

D. The terminals indicate this must be a connecting neuron

Question 20

A major advantage of the reflex arc is:

A. The response to a painful stimulus can be carried out before the stimulus is consciously perceived.

B. It is monosynaptic so only a single neuron is involved for both the stimulus and response

C. The response to a painful stimulus can be carried out as soon as the stimulus is consciously perceived

D. Carrying out a response involves sensory, cognitive and motor brain functions

Question 21

External wounds have to be sealed in order to prevent blood loss and infection. The following list describes several stages that occur during this process.

I Damaged cells release a signal
II Thrombin converts fibrinogen to fibrin
III Fibrin forms a plug
IV Calcium causes the activation of an enzyme

Identify the correct sequence of events:

A. I, II, III, IV

B. I, IV, II, III

C. IV, I, II, III

D. IV, II, III, I

Question 22

One method of manufacturing human stem cells involves exposing human skin cells to mouse feeder cells in order to get them to grow. A group of researchers has completed a study in which they found that it is possible to produce stem cells from fat cells, a process which does not require the use of mouse feeder cells. The advantage to this new process is:

A. The risk of cross species contamination is decreased

B. Stem cells from fats are more versatile

C. Stem cells from fats are less likely to cause an autoimmune response

D. The genetic profile of the stem cells will be identical to that of the donor

Question 23

Hypersensitivity reactions occur because:

A. Cellular receptors detect large quantities of allergens

B. Mast cells degranulate releasing excessive histamine

C. Cytotoxic T cells detect allergens as non self

D. B memory cells release antibodies specific to the allergens

Question 24

A person is taken to hospital after being bitten by a red back spider. They are injected with antivenom. This is an example of:

A. Naturally acquired active immunity

B. Artificially acquired passive immunity

C. Naturally acquired passive immunity

D. Artificially acquired active immunity

Question 25

People with HIV are less able to produce antibodies because the HIV virus specifically targets:

A. T helper cells

B. B Plasma cells

C. B Memory cells

D. Macrophages

END OF SECTION A
TURN OVER

SECTION B - Short-answer questions

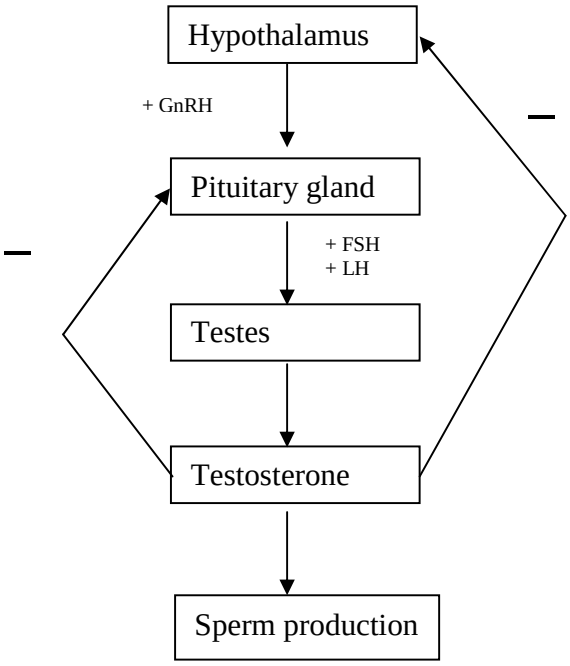
Instructions for Section B

Answer all questions in the spaces provided.

Question 1

Gonadotropin releasing hormone (GnRH) is a peptide hormone that is synthesised by and released from neurons within the hypothalamus.

As shown in the following diagram GnRH stimulates the pituitary gland to release luteinising hormone (LH), which targets the testes to produce the steroid testosterone, and follicle stimulating hormone (FSH), which stimulates the testes to produce sperm.



SECTION B - Question 1 - continued

a. A man goes to a fertility clinic and is found to have a low sperm count. He is treated with GnRH. What would be the expected result of this treatment? Use the information provided to justify your answer.

_____

_____

_____

_____

_____

_____

_____

_____

2 marks

b. What term is used to describe hormones such as GnRH that are secreted by neurons?

_____

1 mark

c. Explain why the hormone GnRH cannot be taken orally.

_____

_____

_____

_____

_____

_____

2 marks

SECTION B - Question 1 – continued

TURN OVER

d. Explain why testosterone and GnRH use different methods of signal transduction. Explain the method of signal transduction associated with each type of hormone.

_____

_____

_____

_____

_____

_____

3 marks

Total 8 marks

Question 2

An Italian group of researchers have been conducting a study into being able to restore eyesight in individuals with damaged corneas. This process involves removing stem cells from the healthy area of a patient's cornea, cloning the cells and then inserting them into the damaged area of the cornea. The procedure was completely successful in 82 out of 107 cases and partially successful in a further 14 cases.

a. Sometimes when transplants occur, the transplanted tissue is rejected. What cells are involved in rejection? Why does rejection occur?

_____

_____

_____

_____

_____

_____

2 marks

SECTION B - Question 2- continued

b. Is rejection cell mediated immunity or humoral immunity? Explain.

_____

_____

_____

_____

_____

_____

2 marks

c. Explain why the patients who undergo the procedure would not need to take antirejection drugs.

_____

_____

_____

_____

_____

_____

_____

_____

2 marks

Total 6 marks

SECTION B – continued

TURN OVER

Question 3

Flowering plants absorb water and inorganic mineral ions through their roots. An example of a root is shown in the picture below.

a. The root is covered by large numbers of smaller root hairs. How does the presence of the root hairs affect the rate of material transport? Provide a reason to support your answer

_____

_____

_____

_____

_____

_____

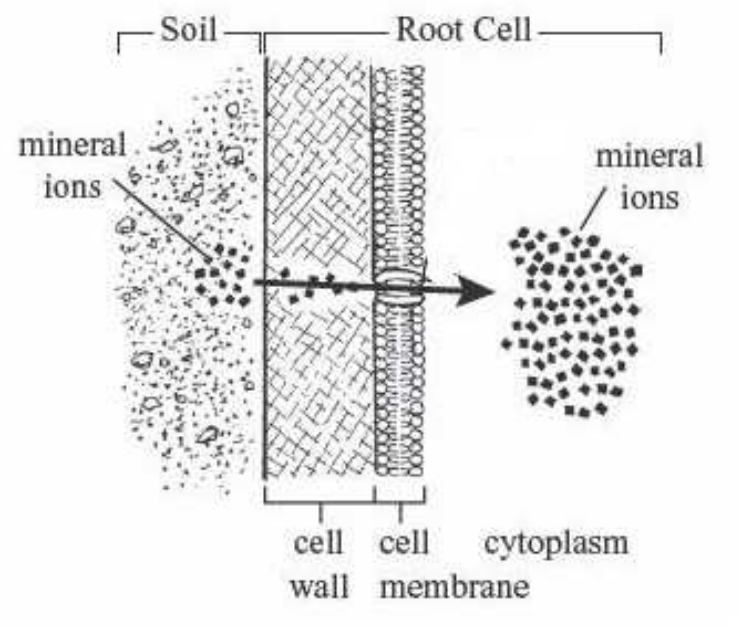
_____

_____

2 marks

SECTION B - Question 3 - continued

The diagram below represents plants taking up mineral ions from the soil.



b. Identify the method of material transport shown in the diagram above. Provide a reason to support your answer.

_____

_____

_____

_____

_____

_____

2 marks

SECTION B - Question 3 – continued

TURN OVER

c. Two students are discussing material transport in plants. Student 1 states that the internal mineral content will have no effect on the plants ability to take up water because water and mineral ions have different concentration gradients. Student 2 disagrees. Which student is most correct? Provide an appropriate justification for your answer.

_____

_____

_____

_____

_____

_____

2 marks

d. Irrigation contributes to salinity because the rising water table brings dissolved salts closer to the surface. Explain how increasing the concentration of the salt solution around the roots of plants can result in the death of the plants.

_____

_____

_____

_____

_____

_____

2 marks

Total 8 marks

SECTION B - continued

Question 4

Pyruvate dehydrogenase complex deficiency (PDHA) is a genetic disorder that affects the Krebs cycle.

The enzyme pyruvate dehydrogenase is responsible for catalysing the reaction where pyruvate is converted into Acetyl Coenzyme A as shown below.

$$\text{Pyruvate} + \text{Coenzyme A} + NAD^+ \rightarrow \text{Acetyl Coenzyme A} + CO_2 + NADH + H^+$$

a. Identify the specific location where the Kerb's cycle occurs.

_____

1 mark

b. How many ATP molecules are produced in the Kreb's cycle per pyruvate molecule?

_____

1 mark

c. What is the function of the NAD+ molecule?

_____

1 mark

d. Explain why a person with PDHA would be expected to have a higher than normal concentration of lactic acid in their blood.

_____

_____

_____

_____

_____

_____

2 marks

SECTION B - Question 4 – continued

TURN OVER

e. A medical researcher suggests that this condition could be treated by supplying an affected individual with a pyruvate supplement. Is this suggestion plausible or not? Provide a reason to support your answer.

_____

_____

_____

_____

_____

_____

2 marks

Total 7 marks

Question 5

Cone snails (*Conus spp.*) are a group of marine gastropods that hunt by shooting barbs containing a mixture of venomous polypeptides into potential prey.

Several of the toxins typically included in cone snail venom are shown below together with their effect.

TOXIN	EFFECT
a-conotoxins	Block muscle acetylcholine receptors
k-conotoxins	Block potassium channels
m-conotoxins	Block sodium channels
w-conotoxins	Block calcium channels
Conopressin	Inhibits antidiuretic hormone
Conantoxin	Inhibits glutamate channels

a. Identify the sub-units of Conopressin.

_____

1 mark

b. Identify the processes by which Conopressin is produced.

_____

1 mark

SECTION B - Question 5 - continued

c. A group of students studying the effects of cone snail venom stated that the venom affects both the electrical and chemical components of the transmission of a nervous impulse. Are they correct? Use the information provided to justify your answer relating to each component of nervous impulse transmission.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

3 marks

d. Explain why severe cases of envenomation (being poisoned) by cone snails results in death due to respiratory and muscular failure.

_____

_____

_____

_____

_____

_____

_____

2 marks

SECTION B - Question 5 – continued

TURN OVER

e. There is currently no antitoxin for cone snail venom, however, if the structure of the venom was as shown below, design an appropriate drug that could be used as an antivenom.

1 mark
Total 8 marks

Question 6
On September 29, 2010, the World Health Organisation recommended that the Southern Hemisphere's 2011 seasonal influenza vaccine contain the following three vaccine viruses:

- an A/California/7/2009 (H1N1)-like virus;
- an A/Perth/16/2009 (H3N2)-like virus;
- a B/Brisbane/60/2008-likevirus.

a. Explain how the administration of a vaccine leads to an immune response.

_____

_____

_____

_____

_____

_____

2 marks

SECTION B - Question 6 - continued

b. The viruses contained in the vaccines are attenuated, explain what this means.

_____

_____

1 mark

c. A person who was vaccinated is exposed to the Perth strain of the influenza virus three weeks after being vaccinated. Explain why they did not experience any symptoms of influenza.

_____

_____

_____

_____

_____

_____

2 marks

d. The person decides not to be vaccinated against influenza in 2012 as they believe that they are now immune to influenza. Provide two reasons to explain why they are incorrect.

_____

_____

_____

_____

_____

_____

2 marks

Total 7 marks

SECTION B – continued

TURN OVER

Question 7

The thyroid gland is responsible for producing thyroid hormone which is responsible for regulating an individual's metabolic rate. Hashimoto's Thyroid disease is an autoimmune disease which targets the thyroid gland and inhibits the function of thyroid hormone.

a. The main symptom of Hashimoto's Thyroid disease is fatigue. Explain why this symptom would be expected in people with Hashimoto's Thyroid disease.

_____

_____

_____

_____

_____

_____

1 mark

b. Define the term autoimmunity.

_____

_____

_____

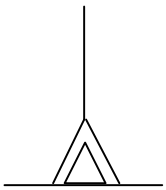
1 mark

SECTION B - Question 7 - continued

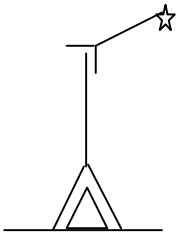
Studies have found that wheat gluten can be a trigger for developing Hashimoto's thyroid disease, with those who are sensitive to wheat gluten being at a higher risk of developing the disease.

One method of determining whether an individual is sensitive to wheat gluten is outlined below.

The allergen (wheat gluten) is placed onto a paper disc



Blood serum from the individual being tested is added. If the person is already producing IgE antibodies specific to wheat gluten then the antibodies will bind to the allergen.



Radioactively labelled anti IgE is added. This will bind to the IgE/antigen complex on the paper disc if there complex is present.

c. The final stage of this process involves exposing the paper disc to X-ray film. Would you expect the X-ray to be completely clear or have a dark spot if the result is positive? Explain.

_____

_____

_____

_____

_____

_____

2 marks

SECTION B - Question 7 – continued

TURN OVER

d. Wheat gluten is a common allergen and sensitised individuals experience hypersensitivity (allergic) responses. Explain how an individual becomes sensitised to an allergen and state what happens when an allergen is encountered after sensitisation has occurred.

_____

_____

_____

_____

_____

_____

2 marks

Total 6 marks

END OF QUESTION AND ANSWER BOOK