



Trial Examination 2017

VCE Biology Unit 3

Written Examination

Question and Answer Booklet

Reading time: 15 minutes

Writing: 1 hour 30 minutes

Student's Name: _____

Teacher's Name: _____

Structure of Booklet

<i>Section</i>	<i>Number of questions</i>	<i>Number of questions to be answered</i>	<i>Number of marks</i>	<i>Suggested time (minutes)</i>
A	25	25	25	30
B	7	7	50	60
			Total 75	Total 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 correction fluid/tape.

No calculator is allowed in this examination.

Materials supplied

Question and answer booklet of 18 pages.

Answer sheet for multiple-choice questions.

Instructions

Please ensure that you write **your name** and your **teacher's name** in the space provided on this booklet and in the space provided on the answer sheet for multiple-choice questions.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

All written responses must be in English.

At the end of the examination

Place the answer sheet for multiple-choice questions inside the front cover of this booklet and hand them in.

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

Students are advised that this is a trial examination only and cannot in any way guarantee the content or the format of the 2017 VCE Biology Units 3&4 Written Examination.

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SECTION A – MULTIPLE-CHOICE QUESTIONS**Instructions for Section A**

Answer **all** questions in pencil on the answer sheet provided for multiple-choice questions.

Choose the response that is **correct** or that **best answers** the question.

A correct answer scores 1; an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1

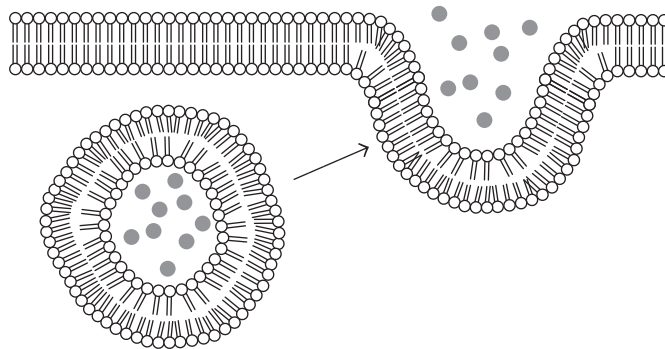
The main two components of membranes are called

- A. proteins and nucleic acids.
- B. nucleic acids and phospholipids.
- C. steroids and proteins.
- D. proteins and phospholipids.

Question 2

The term used to describe the condition of the cells of a freshwater plant when placed in a saline environment is

- A. turgid.
- B. lysed.
- C. plasmolysed.
- D. dehydrated.

Question 3

The process illustrated in the diagram above is

- A. exocytosis.
- B. phagocytosis.
- C. passive movement.
- D. the only way proteins can cross the membrane.

Question 4

Within eukaryotic cells, DNA provides a set of instructions for the manufacture of proteins.

The processes that are involved in the expression of a protein, listed in the correct order, are

- A. transcription, translation and RNA processing.
- B. transcription, RNA processing and translation.
- C. translation, transcription and RNA processing.
- D. translation, RNA processing and transcription.

Question 5

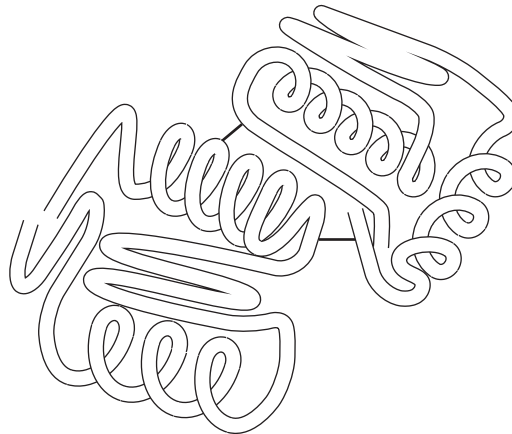
A sequence of DNA contains 15% adenine.

The proportion of the molecule that contains cytosine and guanine complementary pairs would be

- A. 70%
- B. 30%
- C. 35%
- D. 15%

Question 6

The following diagram is of a functional protein.



The highest level of hierarchical structure for the functional protein is

- A. primary.
- B. secondary.
- C. tertiary.
- D. quaternary.

Question 7

The main difference between gene expression in eukaryotes compared to prokaryotes is that

- A. prokaryotes are comprised of single-stranded DNA, whereas eukaryotes are comprised of double-stranded DNA.
- B. eukaryotes splice out introns, whereas prokaryotes do not.
- C. eukaryotes involve RNA polymerase, whereas prokaryotes do not involve RNA polymerase.
- D. prokaryotes have a repressor to deactivate genes, whereas eukaryotic genes are always active.

Use the following information to answer Questions 8 and 9.

There is a protein-digesting enzyme in fresh pineapple that prevents pineapple jelly from setting. An experiment was conducted where fresh pineapple was exposed to a variety of temperatures for 10 minutes and then immersed into set volumes of liquid jelly (a mixture of water, flavours and a protein called gelatin). The jelly was then placed in the refrigerator to provide the best conditions for the jelly to set. The 'setability' of the jelly was measured by timing how long a set volume of the jelly took to run down an inclined glass panel. The results are shown in the table below.

Temperature pineapple was exposed to ($^{\circ}\text{C}$)	Time taken for jelly to run (seconds)
20	40
30	10
40	15
50	250
60	500

Question 8

Three controlled conditions in the experiment were

- the temperature of pineapple incubation, the time taken for the jelly to run, and the volumes of jelly used.
- the volume of jelly used, the time the jelly was exposed to different temperatures, and the placing of the jelly into the refrigerator.
- the time taken for the jelly to run, the type of jelly used and the angle of the inclined glass panel.
- the temperature of jelly incubation, the time the jelly was incubated for, and the length of the glass panel.

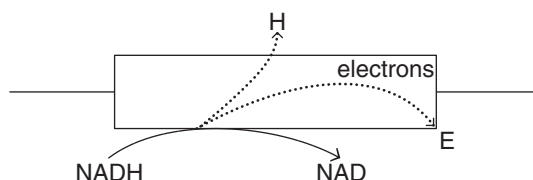
Question 9

A suitable explanation of the results would be that

- high temperatures lead to a reduction of the collisions between the substrate and the enzyme.
- low temperatures denature the enzyme.
- high temperatures change the shape of the active site of the enzyme.
- the optimum temperature for the enzyme would be 30°C .

Question 10

The diagram below simplifies what occurs to NADH at the cristae of the mitochondria. The electrons (E) are available for oxygen to eventually form water. The hydrogen (H) forms a concentration gradient across the mitochondrial membrane.



Once the NADH offloads its hydrogen and electrons it would

- collect more hydrogen from the breakdown of molecules in the Krebs cycle.
- collect more hydrogen from the breakdown of water within the grana.
- digest the NAD into raw materials so it could be recycled.
- move to the cytosol to collect more hydrogen from the condensation of amino acids at the ribosome.

Question 11

The endosymbiotic theory suggests that the mitochondria and chloroplast were engulfed as prokaryotes and became an integral part of the cell.

The evidence in support of this theory would include both organelles

- A. are involved in complex biochemical pathways.
- B. carry linear strands of DNA.
- C. have two membranes.
- D. contain ribosomes identical to those found in the cytosol.

Question 12

Which aerobic respiration equation is the most accurate out of the following?

- A. $C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2 + 36/38 \text{ ATP}$
- B. $C_6H_{12}O_6 + 6O_2 + 36/38 \text{ Pi} + 36/38 \text{ ADP} \rightarrow 6H_2O + 6CO_2 + 36/38 \text{ ATP}$
- C. $C_6H_{12}O_6 + 6CO_2 + 36/38 \text{ Pi} + 36/38 \text{ ADP} \rightarrow 6H_2O + 6O_2 + 36/38 \text{ ATP}$
- D. $6H_2O + 6CO_2 + 36/38 \text{ Pi} + 36/38 \text{ ADP} \rightarrow C_6H_{12}O_6 + 6O_2 + 36/38 \text{ ATP}$

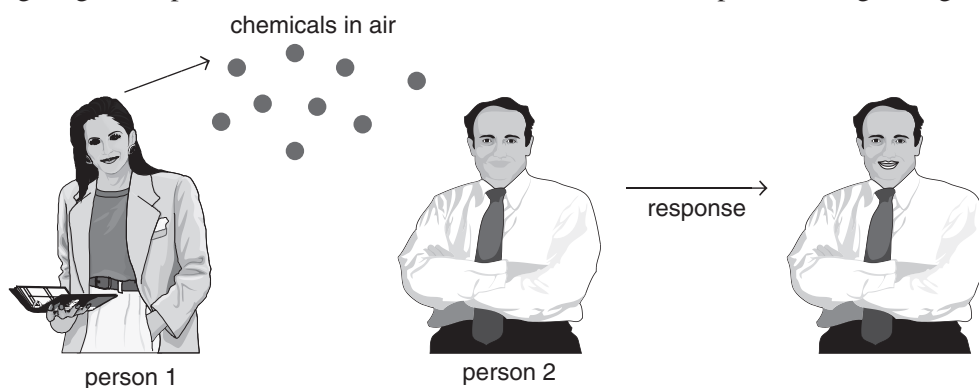
Question 13

Which of the following appropriately pairs a reaction with its associated site?

- A. Polypeptide manufacture occurs in the nucleus.
- B. Glycolysis occurs in the matrix of the mitochondria.
- C. Transcription occurs at the ribosomes.
- D. The light-independent reaction occurs in the stroma of the chloroplast.

Question 14

The following diagram depicts the mode of transmission and action of a particular signalling molecule.



The signalling molecule is called a

- A. pheromone.
- B. neurotransmitter.
- C. animal hormone.
- D. plant growth regulator.

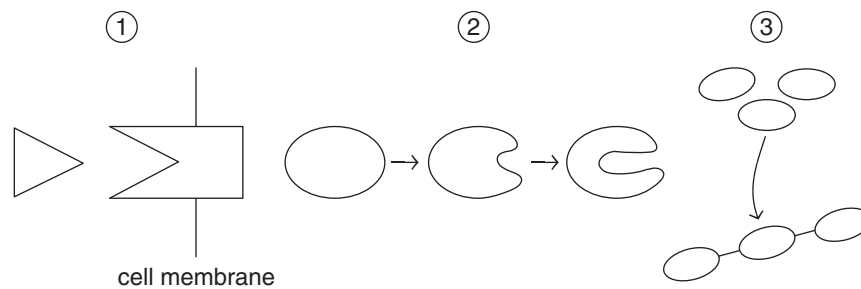
Question 15

If the rate of apoptosis is slower than the rate of cell reproduction in a fully grown organism, the most likely outcome would be

- A. a decrease in size.
- B. cancer.
- C. multiple sclerosis (MS).
- D. larger cells.

Question 16

The following diagram depicts the main steps of signal transduction within a cell.



In the correct order, steps 1 to 3 are

- A. reception, transduction and response.
- B. transduction, reception and response.
- C. response, transduction and reception.
- D. reception, response and transduction.

Question 17

A non-cellular pathogen includes

- A. HIV.
- B. the bacteria that causes salmonella.
- C. the protozoan that causes amoebic dysentery.
- D. the fungus that causes tinea.

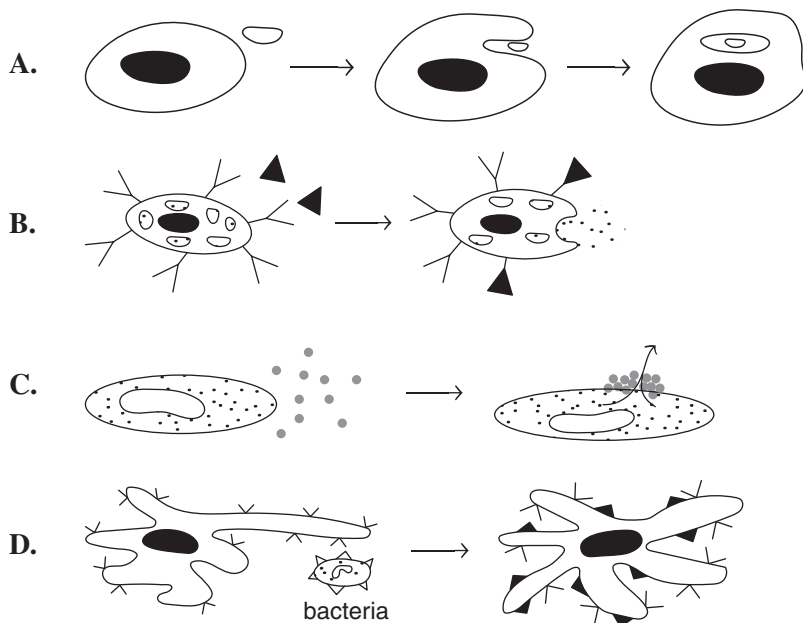
Question 18

A microbiological barrier in animals that may prevent the entry of pathogens into the body would be

- A. unbroken skin that prevents the entry of malarial plasmodium into the bloodstream.
- B. the presence of the antibacterial lysozyme in tears to prevent eye infections such as conjunctivitis.
- C. active ciliated cells bathed in mucus to prevent the influenza virus binding to lung cells.
- D. the presence of natural bacteria in the gut that reduce the potential of pathogens entering the bloodstream.

Question 19

Which of the following diagrams best depicts the action of a macrophage?

**Question 20**

The lymphatic system is a separate system to the circulatory system, but both systems have close cellular contact.

One of the main purposes of the lymphatic system is to

- A. transport lymphocytes to the site of infection.
- B. transport oxygen to the cells they are in close contact with.
- C. transport antigens to lymph nodes.
- D. provide an alternate route for transport of requirements when there are blockages in the circulatory system.

Question 21

Acquired immunity is an adaptation that provides the human body protection when faced with a variety of antigens.

A logical sequence of events leading to acquired immunity would be naive

- A. T cells differentiating into plasma cells.
- B. B cells differentiating into cytotoxic T cells.
- C. B cells differentiating into plasma cells and memory B cells.
- D. T cells differentiating into helper T cells and memory B cells.

Question 22

The Immunise Australia Program currently subsidises vaccines against 16 diseases. The idea behind the program is to attract more people to become protected against disease.

Which of the following is a benefit of such a program?

- A. To provide herd immunity against particular diseases.
- B. To reduce the medical costs necessary for the treatment against particular diseases.
- C. To lower the risk of the unvaccinated coming in contact with pathogens.
- D. all of the above

Question 23

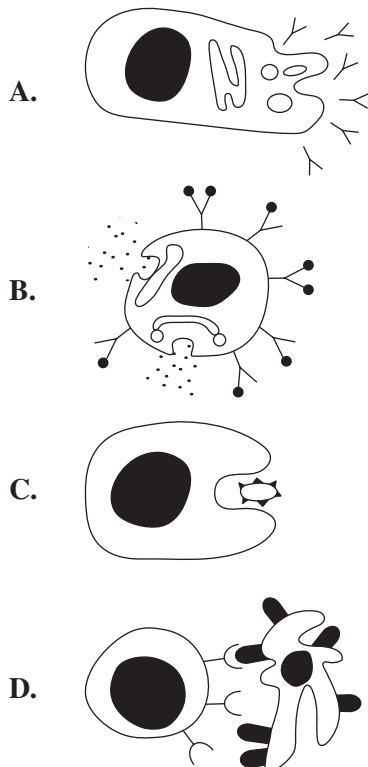
An example of an autoimmune disease would be

- A. acquired immune deficiency syndrome.
- B. MS.
- C. Creutzfeldt–Jakob disease.
- D. an allergy to pollen.

Question 24

An allergic reaction is a learned response by the immune system.

Which of the following diagrams best illustrates an allergic response?



Question 25

Callan is bitten by a tiger snake and is lucky to be near a hospital for medical treatment. He is treated with a needle containing antibodies against the tiger snake’s venom.

As a result of this procedure, Callan could be advised he has had a form of treatment that is

- A. artificial and active.
- B. long-lasting.
- C. going to require booster shots if he is to remain healthy.
- D. artificial and passive.

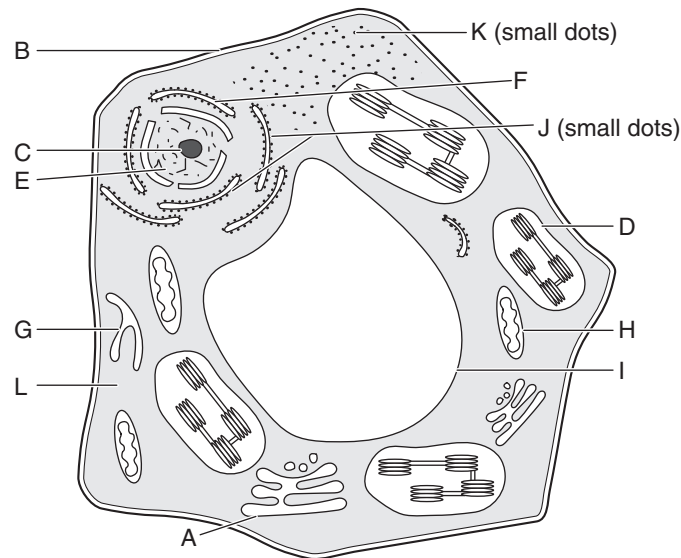
END OF SECTION A

SECTION B – SHORT-ANSWER QUESTIONS**Instructions for Section B**

Answer **all** questions in the spaces provided. Write using black or blue pen.
Unless otherwise indicated, the diagrams in this book are **not** drawn to scale.

Question 1 (5 marks)

The following diagram is of a plant cell and A to L are parts of the cell.



- a. Which structure(s) contain DNA? 1 mark

- b. Which structure(s) are involved in the production of ATP? 1 mark

- c. Where would lipophobic signalling molecules be likely to interact with a receptor? 1 mark

- d. Which structure(s) would contain thylakoid membranes? 1 mark

- e. If this cell was to manufacture and secrete a protein, which structure(s) would be directly involved? You must include them in correct order from manufacture to secretion. 1 mark

Question 2 (8 marks)

Beetroot cells contain a red pigment called betalin, which causes their red colour. When the cell membrane surrounding a beetroot cell is damaged, betalin is released and the colour of the water solution that beetroot slices are immersed in turns red. The colour change is proportional to the level of damage to the membrane. When conducting experiments with beetroot, qualitative and quantitative data can be collected.

An experiment investigating the effect of ethanol (an alcohol) on membrane damage was conducted. 1 cm³ samples of beetroot were immersed into solutions containing an increasing percentage of ethanol and after 30 minutes, the colour intensity of the solution was measured by determining colour by eye as well as using a colorimeter (transparency percentage). The results are illustrated in the table below.

Ethanol (%)	Colour of solution	Transparency (%)
0	clear	100
0.5	clear	98
1	pink	85
10	pink	60
25	light red	45
50	red	15

- a. i. Use the data collected to describe the advantage of quantitative data over qualitative data.

2 marks

- ii. Use the experimental results to explain the purpose of an experimental control.

1 mark

Ethanol is a lipophilic and hydrophilic substance that can be tolerated by cells in small concentrations; however, as the concentration of alcohol increases the level of damage to the membrane increases.

- b. Using an understanding of membrane structure, explain why high levels of ethanol causes the transparency to be low.

1 mark

Question 3 (6 marks)

The following DNA strand is from a section of the gene that codes for a part of the haemoglobin protein.

coding 5' TATGCTATCAGC 3'
 template 3' ATACGATAGTCG 5'

- a.** Determine the mRNA sequence from the DNA strand above. 1 mark

The table below can be used to determine the amino acid order for a particular mRNA sequence.

		second base				
		U	C	A	G	
first base	U	UUU } phe UUC } UUA } leu UUG }	UCU } UCC } ser UCA } UCG }	UAU } tyr UAC } UAA } stop UAG }	UGU } cys UGC } UGA } stop UGG } trp	U C A G
	C	CUU } CUC } leu CUA } CUG }	CCU } CCC } pro CCA } CCG }	CAU } his CAC } CAA } gln CAG }	CGU } CGC } arg CGA } CGG }	U C A G
	A	AUU } AUC } ile AUA } met/ AUG } start	ACU } ACC } thr ACA } ACG }	AAU } asn AAC } AAA } lys AAG }	AGU } ser AGC } AGA } arg AGG }	U C A G
	G	GUU } GUC } val GUA } GUG }	GCU } GCC } ala GCA } GCG }	GAU } asp GAC } GAA } glu GAG }	GGU } GGC } gly GGA } GGG }	U C A G

- b.** Determine the amino acid order of the mRNA strand from part **a.** 1 mark

- c.** Describe the role of anticodons in the process that leads to the production of a protein. 2 marks

The functional haemoglobin protein is comprised of four polypeptide chains and a total of about 500 amino acids.

- d.** Using an understanding of amino acid structure, discuss how polypeptides are held together to form a functional protein. 2 marks

Question 4 (8 marks)

A botanist was interested in the effect that depth and light intensity had on the growth of a marine algae commonly called sea lettuce (*Ulva lactuca*). He set up an experiment on an ocean shelf where he placed the same mass of *U. lactuca* at every 10 m depth up to 80 m. Some of the results showing the mass change of *U. lactuca* after one month are displayed in the table below.

Depth (m)	Mass change of <i>U. lactuca</i> after one month (g)
0	200
20	210
40	180
60	120
80	65

- a. State **two** problems with the design of this experiment and explain how **one** of these problems would change the accuracy of the data collected. 3 marks

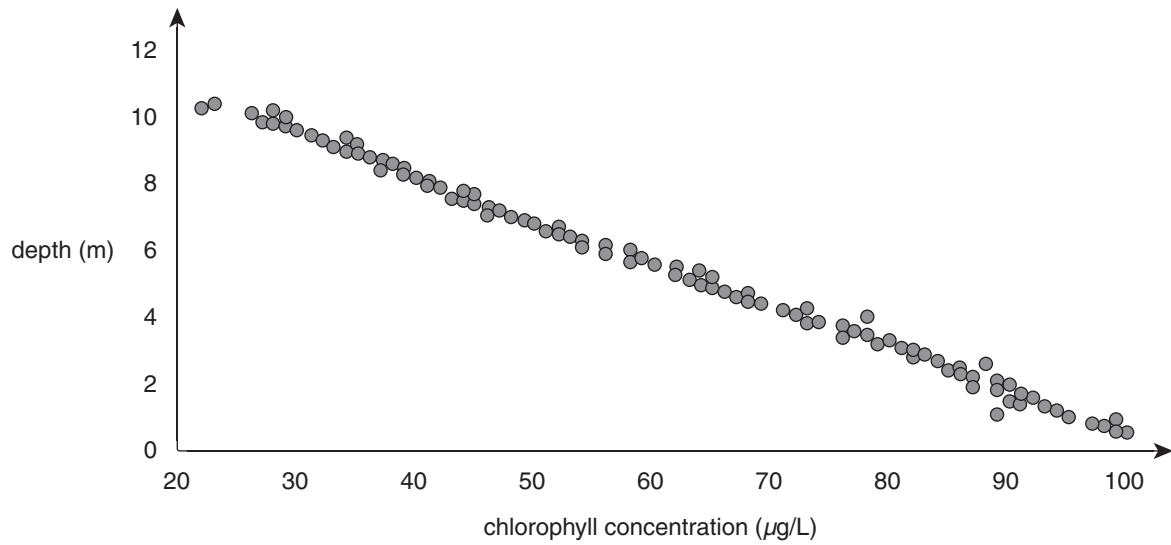
Autotrophs often compensate with environmental stresses by possessing adaptations that assist their survival.

- b. Define autotroph. 1 mark

One such adaptation is the concentration of chlorophyll dispersed within the photosynthetic tissues.

- c. Discuss the cellular location of chlorophyll within the photosynthetic tissues of autotrophs such as *U. lactuca*. 2 marks

The graph below illustrates the relationship between chlorophyll and depth up to 10 m for the common aquatic weed *Myriophyllum aquaticum* when grown in this environment for three weeks.

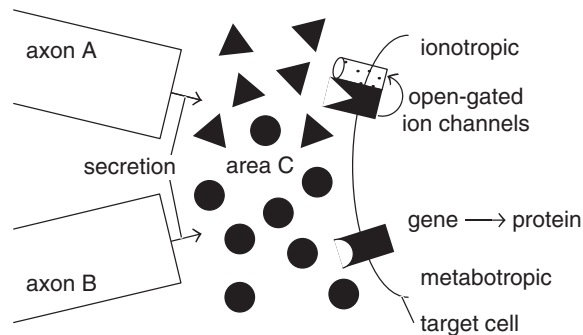


- d. i.** Discuss the survival advantage to *M. aquaticum* for this relationship. 1 mark

- ii.** What is the chlorophyll concentration of *M. aquaticum* at a depth of 5 m? 1 mark

Question 5 (7 marks)

Different neurotransmitters can exert different effects on a target cell. One of the effects is ionotropic and another effect is metabotropic. The diagram below illustrates the action of two different neurotransmitters on a target cell that contains two different receptors, one ionotropic and the other metabotropic.



- a. i.** Name area C. 1 mark

- ii.** Name the type of secretion involved from both axon A and axon B. 1 mark

- b.** In terms of signal transduction, use the diagram to describe both types of actions. 2 marks

- c.** Describe the evidence available to suggest that both neurotransmitters are hydrophilic. 1 mark

A metabotropic response is longer lasting than an ionotropic response. Glutamate is a neurotransmitter that exerts an amplified and longer lasting metabotropic response.

- d.** Use your knowledge, as well as information provided in the diagram, to describe why a metabotropic response is longer lasting than an ionotropic response. 2 marks

Question 6 (7 marks)

There is a lot of media coverage about whether or not to vaccinate. There is an overwhelming amount of scientific data that supports the need for government vaccination programs. Viral diseases, such as measles, mumps and rubella (MMR) are not transmitted from a vaccinated person.

- a.** Describe the general structure of a virus. 1 mark

- b.** Describe the contents of a single MMR vaccine that will lead to immunity against the three viral diseases. 1 mark

- c.** Discuss why the immune system response is amplified and faster when second and third vaccines against the same viruses are given to an individual. 2 marks

HIV carries proteins on its surface that only allows it to enter immune cells that control the immune response, and as a result, the immune system stops functioning effectively over time.

- d. i.** Name the immune system cell HIV effects. 1 mark

- ii.** Vaccines against HIV have been ineffective.
Use the following words to explain why this is the case. (You may use variants of the words; for example, *mutates* or *replicates*.) 2 marks

antigen, mutation, replication


Question 7 (9 marks)

In 2016 there were over 130 000 new cases of cancer in Australia. About 70% of those cases are expected to survive for five years or more with the current treatments. New areas of research, such as the use of monoclonal antibodies in cancer treatment, have given new hope to cancer sufferers and are expected to increase survival rates.

The production of monoclonal antibodies involves an in-depth understanding of the immune system and how it functions. The immune system has the capacity to distinguish between self and non-self antigens.

- a. Describe the difference between self and non-self antigens. 1 mark

Cancer cells are not usually targeted by the immune system and as a result aggressive treatments have been used (chemotherapy and radiotherapy) with some success. However, cancer cells are highly abnormal cells within the body (wrong shape, wrong size, wrong body location) and some cancer cells display unusual antigens which may be a target for immunotherapy. Antibodies can be manufactured that target these unusual antigens.

- b. Draw a labelled antibody in the space provided below. Show the quaternary structure of the functional protein, the antigen binding site(s) and the bonds that hold the quaternary structure together. (Note: The antigen has the following shape ) 3 marks

The antibodies are manufactured within specially bred mice where a small amount of the antigen is administered to the mouse. The mouse's immune system then develops an active immune response against the antigen.

- c. Describe how the mouse's immune system acts against the antigen. 2 marks

One such antigen is the CD52 antigen that is found in higher concentrations on some cancerous white blood cells that cause leukaemia (an abnormal growth of lymphocytes). The antibodies against CD52 can be made in the laboratory as monoclonal antibodies.

- d. i.** How would this form of treatment be more likely to target the cancer cells causing leukaemia (lymphocytes) rather than normal lymphocytes? 1 mark

- ii.** Describe **one** potential side effect with this treatment. 1 mark

- iii.** What would make this form of treatment better than the traditional treatments such as chemotherapy and radiotherapy? 1 mark

END OF QUESTION AND ANSWER BOOKLET