Neap

Trial Examination 2021

VCE Biology Unit 3

Written Examination

Question and Answer Booklet

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

Student's Name: _____

Teacher's Name: _____

Structure of booklet

Section	*Number of questions*	*Number of questions to be answered*	*Number of marks*
A	25	25	25
B	6	6	50
			Total 75

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

Write your **name** and your **teacher's name** in the space provided above on this page, and on the answer sheet for multiple-choice questions.

Unless otherwise indicated, diagrams in this booklet 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.

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 2021 VCE Biology Units 3&4 Written Examination.

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 booklet are **not** drawn to scale.

Question 1

Several bacterial cells held together by antibodies move into a macrophage. A portion of the macrophage membrane folds in on itself to encapsulate the cellular mass within a vesicle in the cytosol of the cell.

The process described is

A. pinocytosis.

B. exocytosis.

C. endocytosis.

D. facilitated diffusion.

Question 2

Cell membranes can maintain their structure when exposed to temperature variations within a certain tolerance range.

A factor that contributes to the stability of a cell membrane when exposed to temperature variations within its tolerance range is the

A. movement of peripheral proteins laterally within the membrane.

B. hydrophilic fatty acid tails of the phospholipids maintaining their interactions with each other when the temperature varies.

C. presence of cholesterol to stop the fatty acids from crystallising at low temperatures.

D. mosaic pattern of the hydrophobic phosphate heads that allows lateral movement within the membrane.

Question 3

What is the entire set of proteins produced by an organism referred to as?

A. genome

B. proteome

C. spliceosome

D. nucleosome

Question 4

Ribosomes can be isolated and purified from cells.

If ribosomes were analysed for their biochemical structure, the analysis would show that they comprise

A. protein and mRNA.

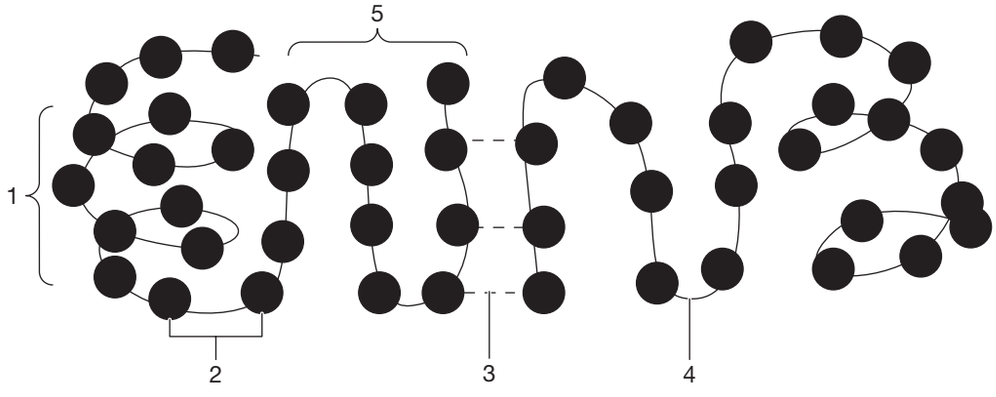
B. protein and tRNA.

C. protein and rRNA.

D. protein, rRNA, mRNA and tRNA.

Question 5

The following diagram represents a biomacromolecule that carries out a function within the cytosol of most cells.



What areas or components of the biomacromolecule do the labels 1–5 in the diagram above represent?

	1	2	3	4	5
A.	β-sheet	amino acids	peptide bond	β-helix	disulfide bond
B.	disulfide bond	α-helix	amino acids	β-sheet	peptide bond
C.	peptide bond	random coil	β-sheet	amino acids	β-helix
D.	α-helix	amino acids	disulfide bond	peptide bond	β-sheet

Question 6

Consider the following DNA template sequence.

GGA TGT CGA CTA GGC

If this template were transcribed, what would be the sequence of the resultant molecule?

A. GGA TGT CGA CTA GGC

B. CCT ACA GCT GAT CCG

C. CCU ACA GCU GAU CCG

D. GGA UGU CGA CUA GGC

Question 7

In most eukaryotic organisms, there are more types of proteins produced than there are genes that produce the proteins.

The term that describes this phenomenon is

A. alternative splicing.

B. RNA processing.

C. DNA processing.

D. transcriptional modification.

Use the following information to answer Questions 8 and 9.

The following sequence represents the first 12 amino acids from one of the insulin polypeptides.

Gly-Ile-Val-Glu-Gln-Cys-Cys-Ala-Ser-Val-Cys-Ser

Question 8

The hierarchical level that these 12 amino acids represent is the

A. primary level.

B. secondary level.

C. tertiary level.

D. quaternary level.

Question 9

To form the amino acid sequence, a coordinated series of steps should occur in particular cellular locations and in a particular order.

Which row best represents the steps and the locations in which these steps occur?

	Step 1	Location 1	Step 2	Location 2
A.	RNA polymerase	cytosol	anticodons	degeneracy
B.	translation	rough endoplasmic reticulum	transcription	ribosome
C.	promotion	nucleus	operation	rough endoplasmic reticulum
D.	transcription	nucleus	translation	ribosome

Question 10

Enzymes are

A. always proteins.

B. reusable.

C. never subject to irreversible inhibition.

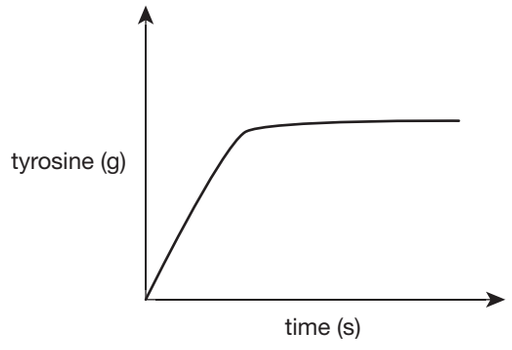
D. never subject to reversible inhibition.

Question 11

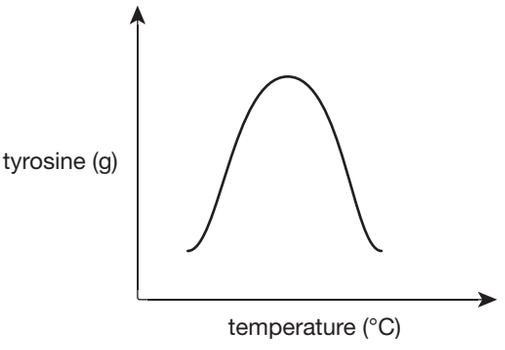
Phenylalanine hydroxylase catalyses the conversion of phenylalanine into tyrosine.

Which one of the following graphs best represents 5 g of substrate being converted into 5 g of product?

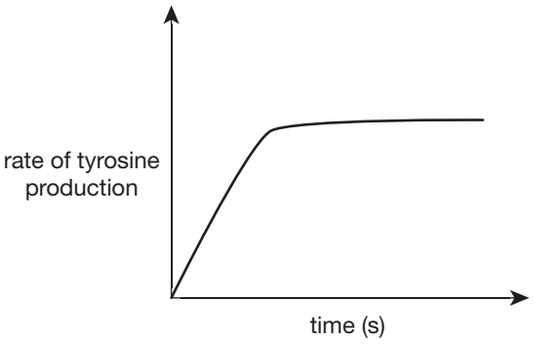
A.



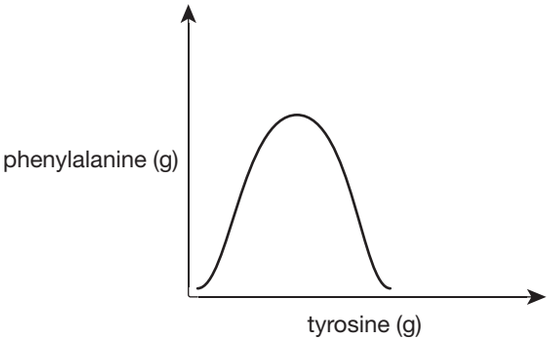
B.



C.



D.



Question 12

With respect to the coenzymes NADH and NADPH, it is correct to state that

A. NADH is the product of phosphorylation and NADPH is formed from NADH.

B. NADH is formed during glycolysis and NADPH is used during the Calvin cycle.

C. NADH is formed in the stroma and NADPH is formed during the Krebs cycle.

D. NADH is a nitrogen carrier and NADPH is a phosphorus carrier.

Question 13

A student was trying to learn the balanced chemical equation for photosynthesis. She wrote the equation down, cut it up into individual chemicals and then jumbled them up. The individual chemicals are shown below.

$$12H_2O \qquad C_6H_{12}O_6 \qquad 6CO_2 \qquad 6O_2 \qquad 6H_2O$$

Which one of the following shows the balanced chemical equation for photosynthesis?

A. $C_6H_{12}O_6 + 6O_2 + 6H_2O \rightarrow 6CO_2 + 12H_2O$

B. $C_6H_{12}O_6 + 6O_2 + 12H_2O \rightarrow 6CO_2 + 6H_2O$

C. $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 12H_2O$

D. $6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$

Question 14

A molecule secreted from a white blood cell that stimulates apoptosis of a pre-cancerous cell could be called a

A. pheromone.

B. hormone.

C. cytokine.

D. neurotransmitter.

Question 15

Androstenone is a signalling molecule that moves between males and females of some species to promote reproductive behaviour. In male pigs, androstenone is secreted from the salivary gland, and then travels through the air to the olfactory cells of female pigs. At the olfactory cells, the androstenone binds to intracellular receptors and triggers an appropriate reproductive response.

This information is consistent with androstenone being

A. lipophilic.

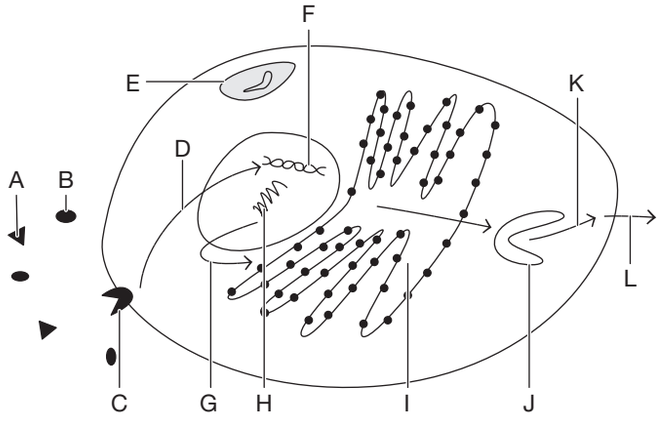
B. hydrophilic.

C. lipophobic in nature so it can travel through the air.

D. an extremely common hormone in the animal kingdom.

Question 16

The diagram below shows the action of gibberellic acid on the secretion of amylase from an aleurone cell within a germinating seed.



This process can be referred to as signal transduction.

Which letters in the diagram above represent the signalling molecule, receptor, second messengers and response?

	Signalling molecule	Receptor	Second messengers	Response
A.	A	C	D	L
B.	A	B	C	H
C.	B	C	F	K
D.	E	F	H	I

Question 17

Apoptotic bodies are formed when

A. the cytoskeleton is being damaged by the death receptor.

B. the caspase cleaving DNA forms blebs, which are nucleus fragments.

C. the cytoskeleton is cleaved by caspase and the cell can no longer hold its normal shape.

D. cytokines secreted from the cell activate localised cells to secrete caspases that are then absorbed by the target cell.

Question 18

Fully grown multicellular organisms, such as humans, exist with a set number of cells, some living for a short period of time and some for a long period. For this to occur, there exists a fine balance between apoptosis and replication of cells.

If the rate of apoptosis is greater than the rate of replication, then

A. tumours can form.

B. undifferentiated cells will appear in areas of the body where they should not appear.

C. autoimmune diseases such as multiple sclerosis may develop.

D. viral diseases may replicate uncontrollably.

Question 19

A person stood on a thorn, which penetrated their skin. A bacterium on the thorn, due to an optimal temperature and plenty of nutrients, thrived within the person's body, which led to an infection.

Which one of the following is the best description of the pathogen?

A. cellular eukaryotic

B. cellular prokaryotic

C. non-cellular antigenic

D. non-cellular viral

Question 20

The most prolific cells of the innate immune system in a relatively disease-free individual human are

A. neutrophils.

B. mast cells.

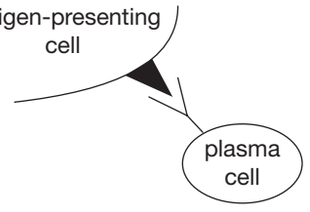
C. dendritic cells.

D. macrophages.

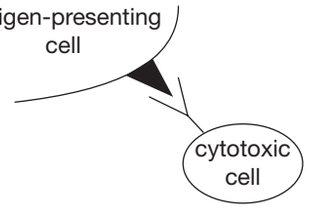
Question 21

Which one of the following shows an appropriate active immune response?

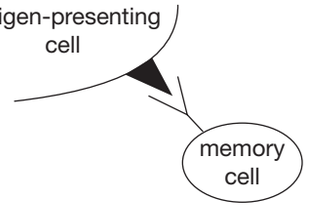
A.



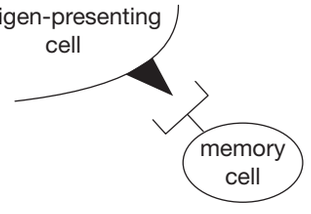
B.



C.



D.



Question 22

A specific naive B cell has been stimulated to undergo clonal selection as a result of contact between an antigen and a complementary receptor on the surface of the cell.

An appropriate response in this scenario would be

A. the secretion of antibodies from T cytotoxic cells at the site of infection that will bind to the antigens on the surface of the pathogens.

B. for T helper cells to secrete antibodies that are released into the circulatory system from the lymphatic system.

C. for B memory cells to secrete cytokines into the circulatory system that will bind to the antigens on the pathogens at the site of infection.

D. the enlargement of some of the cloned B cells that produce more rough endoplasmic reticulum for their specific function.

Question 23

Ipilimumab is an immunotherapeutic drug often prescribed to people with stage III or stage IV melanoma (skin cancer). The therapy involves the administration of an antibody produced against a self-identification marker on the surface of the melanoma cells called PD1 that, if blocked, prevents the completion of the cell cycle within these cells.

The administered antibody marker would

A. be generated by a helper cell.

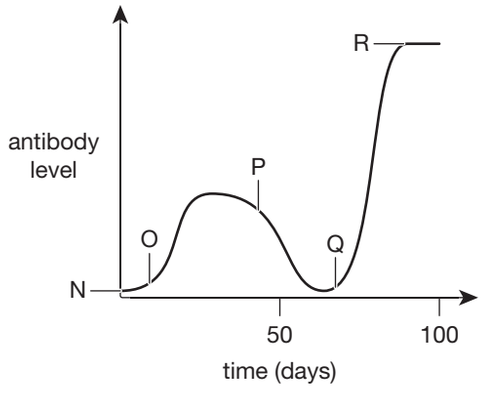
B. be produced in another organism, such as a rabbit.

C. be specific against the PD1 marker on the melanoma cells only.

D. comprise one heavy chain and one light chain.

Use the following information to answer Questions 24 and 25.

The graph below shows the response of the immune system to a vaccination program.



Question 24

A second vaccine was administered at approximately

A. time N.

B. time O.

C. time P.

D. time Q.

Question 25

The level of plasma cells would be highest at approximately

A. time O.

B. time P.

C. time Q.

D. time R.

SECTION B

Instructions for Section B

Answer **all** questions in the spaces provided.
Unless otherwise indicated, the diagrams in this booklet are **not** drawn to scale.

Question 1 (6 marks)
Mitochondria have several features that distinguish them from other organelles, such as a double membrane.

a. Draw a labelled diagram of a mitochondrion, showing the double membrane and **two** other features that distinguish it from other organelles. 3 marks

b. Mitochondria first appeared in eukaryotic cells over 1.45 billion years ago. The theory of endosymbiosis explains how they arose.

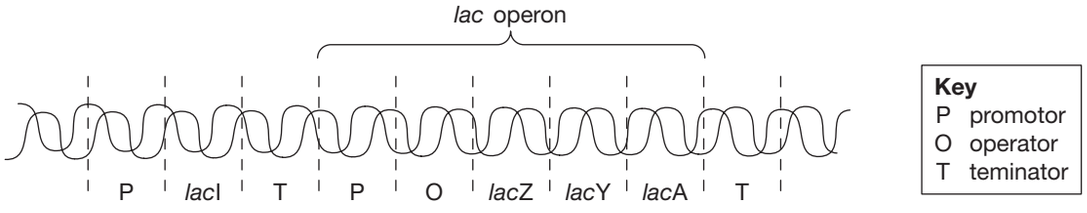
i. The double membrane of mitochondria is used as evidence to support the endosymbiotic theory.

What are the origins of each membrane of mitochondria? 1 mark

ii. State **two** other pieces of evidence that support the endosymbiotic theory. 2 marks

Question 2 (9 marks)

The *lac* operon model of gene control was discovered in 1961 and explained why genes are not active in cells all the time. The diagram below represents a small section of the bacterial genome from the gut bacteria *Escherichia coli (E. coli).*



a. Describe the structural and locational differences of *E. coli* DNA compared to human DNA. 2 marks

The *lac*I gene, when expressed, produces a repressor protein.

b. **i.** Explain whether the *lac*I gene is a regulatory gene or a structural gene. 2 marks

ii. Describe the function of the repressor protein with respect to the *lac* operon. 2 marks

c. What is the purpose of the promotor region of the *lac* operon when lactose is present? 1 mark

d. The *lac* operon genes, when expressed, produce a range of proteins, including a permease protein (allowing the facilitated diffusion of lactose) and the enzyme β-galactosidase (allowing the hydrolysis of lactose).

Discuss how both of these proteins are used by *E. coli* in a lactose-rich environment. 2 marks

Question 3 (10 marks)

Cellular respiration is an important cellular process that occurs in all living cells. In eukaryotes, there are three main stages in cellular respiration.

a. Complete the table below by stating the stage of cellular respiration, **one** input, **one** output and the cellular location of the stage. 4 marks

Name of stage	Input	Output	Cellular location
	glucose		
		carbon dioxide	
			cristae

The 400 m sprint is regarded as highly challenging, and athletes who participate in it need a combination of aerobic and anaerobic endurance. If an athlete competing in the 400 m sprint began the race by sprinting, their body would not generate enough ATP at a rate that would enable them to complete the race at that high level of intensity. Therefore, both aerobic and anaerobic processes in muscle cells are essential for athletes who compete in the 400 m sprint.

b. Complete the table below by stating **one** advantage and **one** disadvantage of each type of respiration listed with respect to the completion of a 400 m race. 4 marks

Type of respiration	Advantage	Disadvantage
aerobic		
anaerobic		

c. An athlete increased the muscle mass of his leg muscles by means of a rigorous training schedule.

Identify one benefit of the athlete's increased leg muscle mass and describe how it would assist the athlete in completing the 400 m sprint faster. 2 marks

Question 4 (9 marks)

Auxin is a plant growth regulator that coordinates processes such as cell division, root and stem tropisms and apical dominance. Auxin levels are higher in undifferentiated cells and decrease following tissue differentiation. Auxin is a polar molecule and so, to complement a range of responses, has a range of cellular locations for receptors.

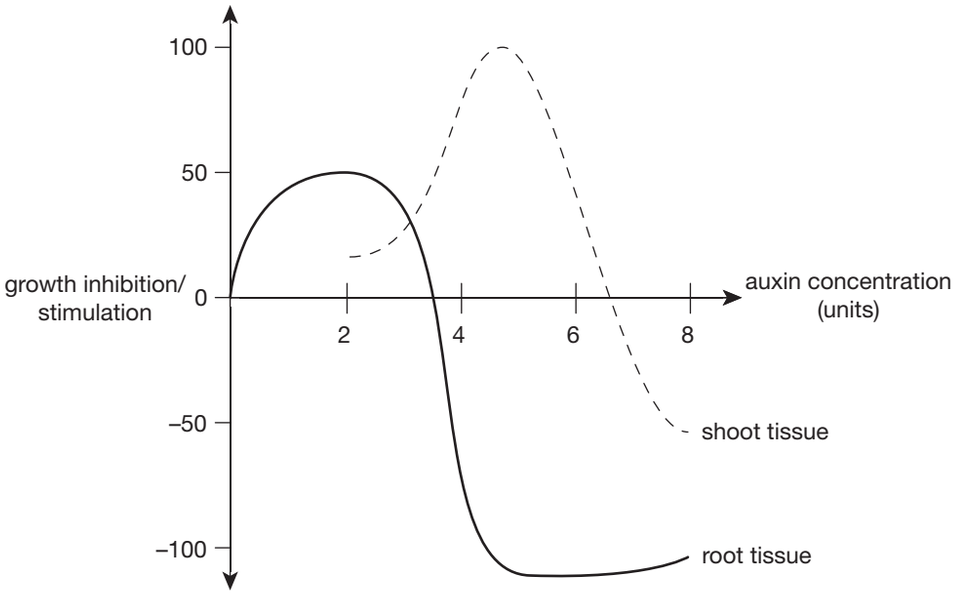
a. With reference to membrane chemical structure and the properties of auxin, explain how plant cells could contain both extracellular and intracellular receptors to auxin. 2 marks

b. Extracellular auxin receptors are located on areas of plants that are actively growing, whereas intracellular receptors are located in cells undergoing cell division.

Describe how different responses could be elicited in different plant cells once auxin meets an intracellular or extracellular receptor. 2 marks

c. Compare plant growth regulator action to neurotransmitter action. 2 marks

The graph below shows the effect of varying the levels of auxin in both root and shoot tissue. Auxin is a gravity sensitive hormone that is produced in the tip of a root and moves away from the tip by diffusion.



d. **i.** State the optimal auxin concentration that will lead to the maximum stimulation of growth in shoots. 1 mark

_____

ii. In an experiment, a root was placed horizontally in the soil. After a short time, it started to grow downwards.

Explain how this could occur with reference to information from the graph. 2 marks

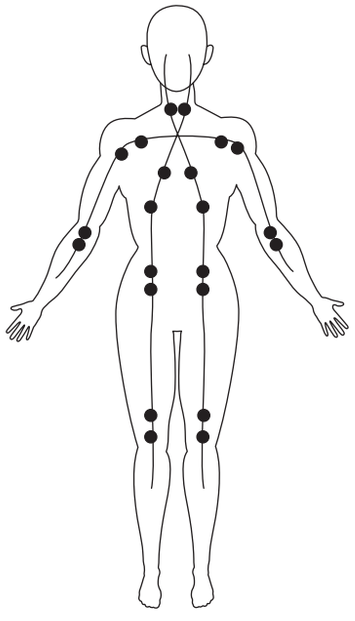
_____

_____

_____

_____

Question 5 (9 marks)
The diagram below is a generalised diagram of the lymphatic system in the human body.



a. On the diagram above, label the location of:

- a lymph node
- a lymphatic duct.

2 marks

b. Why do the components of the lymphatic system all converge at a single point in the upper torso? 2 marks

Antigens on pathogens are often detected as non-self in the extremities of the body. It then takes some time for the body to respond in a specific way to such an antigen.

c. **i.** Give **one** example of a chemical barrier within the body that would usually prevent a pathogen from entering the internal environment and causing disease. 1 mark

ii. Describe the role of T helper cells in the response against a pathogen. 2 marks

Wini and Nilaa were discussing how the terms 'antigen' and 'allergen' are occasionally confused. Wini was adamant that antigens and allergens are always completely different, but Nilaa said that in some circumstances they are the same.

d. Explain whether Wini's or Nilaa's argument is correct. 2 marks

Question 6 (7 marks)

Immunity can be acquired in a multitude of ways. Some common methods by which immunity is acquired are as follows:

- Milk-fed calves are less likely to contract diseases compared to calves that have been weaned from the mother.
- If a person is bitten by a funnel-web spider, they may be administered antivenom as an effective treatment.
- Seasonal vaccinations have been offered to protect against the most likely sources of influenza for the 'flu season'.

Immunity has been acquired by other methods. Prior to vaccinations becoming widely available, some parents would organise 'chickenpox parties', where young children were brought into contact with other children who were infected with chickenpox. By doing this, children could contract the virus at a young age rather than contracting it when they were older. This method of acquiring immunity is not recommended by healthcare professionals.

a. Complete the table below by identifying the type of strategy employed, the type of immunity acquired and the length of the immunity for each method listed. 4 marks

Method	Active/passive/both	Natural/artificial/ both	Long-term/ short-term/both
Milk-feeding baby calves			
Antivenom			
Seasonal vaccination			
Chickenpox parties			

b. Describe step-by-step how immunity is achieved for **one** of the methods listed in the table in **part a.** 3 marks

END OF QUESTION AND ANSWER BOOKLET

Neap

Trial Examination 2021

VCE Biology Unit 3

Written Examination

Multiple-choice Answer Sheet

Student's Name: _____

Teacher's Name: _____

Instructions

Use a **pencil** for **all** entries. If you make a mistake, **erase** the incorrect answer – **do not** cross it out. Marks will **not** be deducted for incorrect answers.
No mark will be given if more than **one** answer is completed for any question.

All answers must be completed like this example: **A** B C D

Use pencil only

1	A	B	C	D
2	A	B	C	D
3	A	B	C	D
4	A	B	C	D
5	A	B	C	D
6	A	B	C	D
7	A	B	C	D
8	A	B	C	D
9	A	B	C	D
10	A	B	C	D
11	A	B	C	D
12	A	B	C	D
13	A	B	C	D

14	A	B	C	D
15	A	B	C	D
16	A	B	C	D
17	A	B	C	D
18	A	B	C	D
19	A	B	C	D
20	A	B	C	D
21	A	B	C	D
22	A	B	C	D
23	A	B	C	D
24	A	B	C	D
25	A	B	C	D