

Trial Examination 2020

VCE Biology Unit 1

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>
A	25	25	25
B	7	7	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 19 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 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.

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

Which one of the following correctly describes a type of living cell, the organelles found within its cell cytoplasm and the function of its organelles?

- A. Some specialised types of white blood cells contain many lysosomes containing enzymes to help break down ingested bacteria.
- B. Pancreatic cells that produce the hormone insulin contain extensive smooth endoplasmic reticulum to transport the protein hormone.
- C. Bone cells contain no nuclei as their main function is to provide strength and support, so they do not need cell regulation and control.
- D. Salivary gland cells contain many ribosomes to synthesise the amylase enzyme protein, but require no Golgi bodies as the enzyme passes directly into the mouth.

Question 2

Depending on the size and shape of cells, their surface area to volume ratio for exchange of substances between the cell cytoplasm and external environment can vary considerably.

Examine the following four cell types and, using the information given and your knowledge, select which cell type will be most efficient for exchange.

	Cell type	Shape	Size
A.	plant leaf cell	brick-like	0.1–0.2 mm × 0.01–0.05 mm
B.	human cheek cell	cuboidal	58 × 57 microns
C.	<i>Elodea</i> water plant cell	box-like	50 × 0.025 microns
D.	mature red blood cell	biconcave disc	7–8 microns diameter

Question 3

Cells can be observed using various types of microscopes.

All cells

- A. observed using a light microscope with high power must be stained to see the presence of internal organelles.
- B. observed using an electron microscope will be dead, as they are stained with heavy metal stains.
- C. containing a nucleus do need to be stained in order to view the nucleus clearly using a light microscope with low power.
- D. containing ribosomes can be viewed using a light microscope with low power to see their organelles clearly.

Question 4

The plasma membrane, containing both lipids and proteins and surrounding the cell cytoplasm,

- A. is only found in eukaryotic cells that contain membrane-bound organelles.
- B. is essential in all living cells as a controlling boundary.
- C. has a fixed structure that does not change during the life of a cell.
- D. contains cholesterol, which makes the membrane less stable.

Question 5

Four major processes of the transport of soluble substances across plasma membranes are essential for efficient functioning in the human digestive system.

These include

- A. absorption of amino acids from a lower concentration in the gut to a higher concentration in the blood by diffusion.
- B. movement of glucose from a higher concentration in the gut to a lower concentration in the blood using energy by the process of facilitated diffusion.
- C. absorption of mineral salt ions down the concentration gradient in the gut into the blood by active transport.
- D. movement of water from a higher water concentration in the gut to a lower water concentration in the blood by the passive process of osmosis.

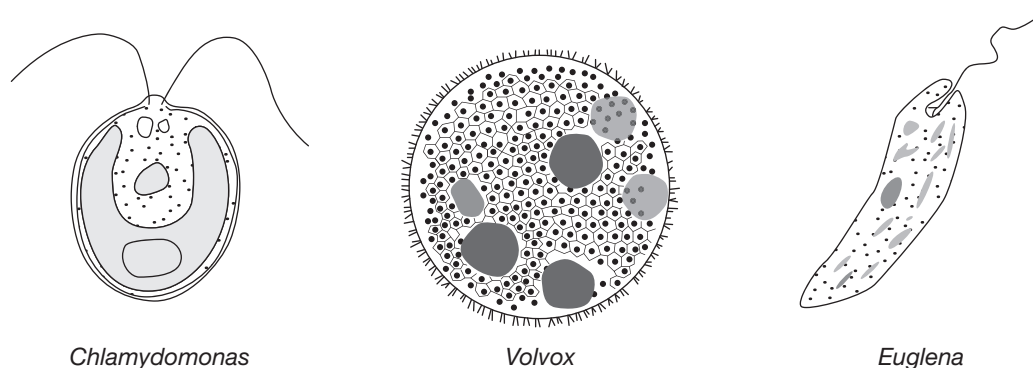
Question 6

Internal compartmentalisation in a cell

- A. enables the cell to carry out different metabolic activities at the same time under different conditions.
- B. comprises all the closed parts within the cytosol of the cell surrounded by a protein layer membrane.
- C. is important for the efficient functioning of both prokaryotic and eukaryotic cells.
- D. provides specific micro-environments so that different biological processes can all occur in the same environment.

Use the following information to answer Questions 7–11.

The diagram below shows a number of organisms.



Chlamydomonas is a unicellular organism that lives in freshwater and saltwater and freely moves around using its two anterior whip-like flagella. It has a large central cup-shaped chloroplast with a red eyespot for photosensitivity. It has a cell wall made of glycoprotein, not cellulose. In freshwater ecosystems, *Chlamydomonas* and other green unicellular and simple multicellular organisms play an important role. Some of these other organisms are also shown in the diagram above.

Question 7

From your knowledge and the information given, which one of the following statements is correct?

- A. As they have a chloroplast for photosynthesis, *Chlamydomonas* cells would not have mitochondria, as usable cellular energy would be obtained directly from the sun.
- B. *Chlamydomonas* would spend daylight hours in deeper water to avoid the warmer surface water heated up by the sun.
- C. The cells of *Chlamydomonas* are well adapted for their functioning as they have eyespots to detect light used in an important cell process.
- D. The *Chlamydomonas* would be classified as a prokaryote as no nuclei are seen in their living cells.

Question 8

Chlamydomonas cells have features present in animals, plants and microorganisms.

In the kingdom level of classification, *Chlamydomonas* are classified in the kingdom

- A. Animalia.
- B. Plantae.
- C. Monera.
- D. Protista.

Question 9

The presence of eyespots in *Chlamydomonas* indicates that they

- A. can carry out responses according to the stimulus-response model.
- B. can carry out coordinated regulated responses.
- C. have homeostatic regulation, as occurs in humans.
- D. use their eyespots as effector structures.

Question 10

Chlamydomonas, *Volvox* and *Euglena* are all important organisms filling similar roles in freshwater ecosystems.

The relationship between these three types of organisms is called

- A. competition.
- B. commensalism.
- C. cooperation.
- D. collaboration.

Question 11

Grouped together in their role in freshwater ecosystems, *Chlamydomonas*, *Volvox* and *Euglena* could be called

- A. zooplankton.
- B. the first trophic level.
- C. second-order producers.
- D. decomposers.

Question 12

Aerobic cellular respiration is more efficient than anaerobic cellular respiration as it

- A. involves the incomplete breakdown of glucose into water and carbon dioxide.
- B. produces waste products: lactic acid in animals and ethanol in plants.
- C. generates more energy stored in ATP molecules per glucose molecule than in anaerobic respiration.
- D. takes place only during the daytime in all living cells.

Question 13

Mosses, ferns, algae, conifers, flowering plants and cyanobacteria can all carry out photosynthesis.

All living cells that carry out photosynthesis must contain

- A. mitochondria.
- B. chloroplasts.
- C. nucleoli.
- D. chlorophyll.

Question 14

The most important part of the human body for controlling the temperature of the internal environment is the

- A. brain.
- B. skin.
- C. heart.
- D. liver.

Question 15

The internal environment of the body includes

- A. body cells.
- B. blood vessels.
- C. body fluids.
- D. lung air sacs.

Question 16

Four students were chosen to visit Antarctica on a special research trip. They were advised about the cold temperature, especially the windchill factor.

Which one of the following students' bodies would be best prepared to increase the heat generation needed in these very cold temperatures?

- A. Tom, who has increased vasodilation in his fingers and toes
- B. Toby, whose muscle cells have increased metabolic rate
- C. Lou, whose body hairs have fluffed up to improve insulation
- D. Shawn, who wore four layers of fine wool clothing for warmth

Question 17

It is nearly 60 years since the discovery of warfarin, an anticoagulant that can be used to prevent deep-vein thrombosis and stroke in some patients. It was first found in mouldy hay made from sweet clover that had been fed to cattle and had caused severe haemorrhaging (internal bleeding).

The type of systematic search for useful products, both food sources and medicinal drugs as in the case of warfarin, is called

- A. biopiracy.
- B. bioprospecting.
- C. biodiversity.
- D. biomimicry.

Use the following information to answer Questions 18–21.

Sea otters are marine mammals found along the coasts of the Pacific Ocean in North America and Asia. They have webbed feet, water-repellent fur, and nostrils and ears that close in the water. Sea otters spend most of their time in the water and are frequently observed lying on their backs in the sea, cracking their food with a stone stored in a pocket under their arm. They have no blubber but are kept warm by their thick fur and by wrapping themselves in the large brown seaweed kelp as they sleep in the water. They feed on fish and marine invertebrates including crabs, sea urchins, mussels and snails.

Question 18

Sea otters have many specific adaptations to help them survive in their marine environment.

Behavioural adaptations include

- A. the pocket under the arm for stone storage.
- B. nostrils and ears that can be closed underwater.
- C. wrapping their bodies in kelp during sleep.
- D. thick, water-repellent fur for body warmth.

Question 19

A sea otter's favourite food is sea urchins. The otter can crack open the sea urchin by lying on its back and using a rock to destroy the sea urchin's spines, gaining access to the meat inside. Other animals cannot get to the meat because of the sea urchin's long sharp spines.

The relationship between the sea otter and the sea urchin is correctly called

- A. host/parasite.
- B. competitor/benefiter.
- C. eater/food.
- D. predator/prey.

Question 20

Sea otter numbers were on a drastic decline in the early 1900s due to humans hunting them for their furs, oil spills and other water pollutants. If all or most of the sea otters disappeared, the sea urchins would be able to reproduce unchecked. Sea urchins feed on kelp stems, which results in the death of the kelp plants.

The result of having fewer sea otters could be that

- A. the kelp marine forests regenerate and flourish.
- B. all the fish and invertebrates populations in the kelp ecosystem increase.
- C. the kelp ecosystem totally collapses.
- D. a flourishing reef of kelp, sea urchins and other invertebrates develops.

Question 21

Sea otters can have an extremely large impact on kelp ecosystems, disproportionate relative to their population size.

Because of this, they are referred to as a

- A. dominant species.
- B. keystone species.
- C. flagship species.
- D. foundation species.

Use the following information to answer Questions 22–25.

A student wrote the following statement:

If yeast is mixed with a glucose solution and warmed to 25°C, then the rate of breakdown of the glucose by anaerobic respiration will be faster than at 15°C.

The student then set up ten test tubes with 1 g of dried yeast in each tube. To five of the test tubes, he added 100 mL of 10% glucose solution at 15°C; 100 mL of the same glucose solution warmed to 25°C was added to the other five tubes. A stopper was immediately placed in each tube and a syringe attached to measure the volume of carbon dioxide given off every twenty seconds. The results were graphed and compared.

Question 22

In scientific methodology, the initial statement written by the student is called a

- A. suggestion.
- B. hypothesis.
- C. prediction.
- D. theory.

Question 23

The use of the same amount of yeast, the same volume and concentration of glucose solution and the same method of measurement for the gas are collectively called

- A. experimental variables.
- B. constant variables.
- C. controlled variables.
- D. control groups.

Question 24

The dependent variable in this experiment was the

- A. total volume of carbon dioxide measured after five minutes.
- B. amount of yeast added to each tube.
- C. temperature of the glucose solution added to each tube.
- D. volume of carbon dioxide being given off every twenty seconds.

Question 25

The student set up five test tubes at each temperature because, for the conclusion of a scientific experiment to be convincing, the researcher must report adequate evidence.

Scientific evidence should include

- A. results from an experiment with just one trial.
- B. results from only the trials that produced the expected results.
- C. results from multiple different types of experiments, including unexpected results.
- D. results from the multiple trials of one experiment, including unexpected results.

END OF SECTION A

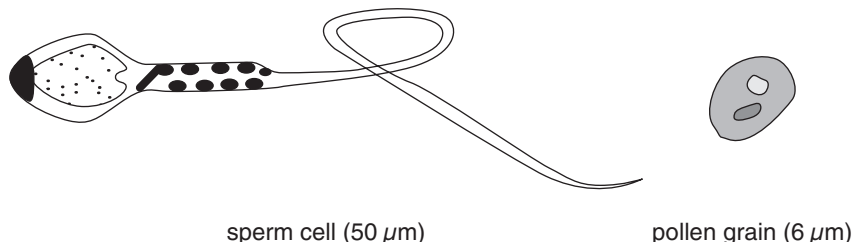
SECTION B**Instructions for Section B**

Answer **all** questions in the spaces provided. Write using blue or black pen.

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

Question 1 (7 marks)

The following diagrams are of two highly specialised cell types involved in the stage of fertilisation during sexual reproduction in animals and plants, including their approximate size.



- a. Are these two cell types be considered eukaryotic or prokaryotic cells? Justify your answer using evidence from the diagrams. 1 mark

Both cell types locate and fertilise an egg, but one of them cannot move independently and the other is highly mobile.

- b. i. Name the cell which is highly mobile **and** identify the structural feature that the cell possesses to allow this mobility. 1 mark

- ii. Examine the diagram of the cell named in **part b.i.**
Describe the importance of the cluster of oval, double-membrane bound organelles found in the mid-region of this cell. 1 mark

- c.** The cell **not** selected in **part b.i.** is not able to move by itself but must still be able to reach the egg for fertilisation.

- i.** Suggest **one** way this cell may reach an egg. 1 mark

- ii.** Using the information in the diagram, identify a structural feature that may aid this cell to reach the egg. 1 mark

Neither of these cells, once mature, could be considered to be tissues.

- d. i.** What is meant by the term 'tissue'? 1 mark

- ii.** Why, when the two cells are mature, can they **not** be considered tissues? 1 mark

Question 2 (4 marks)

Most cells in mammalian systems have certain features in common, including the presence of a nucleus, a semi-permeable plasma membrane and other membrane-bound organelles. Initial experimental results and chemical analysis suggested the membrane was like two pieces of bread with a layer of cheese in-between, and so the ‘sandwich model’ was proposed.

Further testing using molecules of different sizes and ions of different charges indicated that this was incorrect. Continuing with the analogy, it was instead proposed that the membrane consisted of the two bread layers with cheese tubes passing through from one side to the other, allowing movement of the molecules. This is called the ‘fluid mosaic’ model.

- a. i.** In the ‘fluid mosaic’ model analogy, what do the two slices of bread and the cheese tubes represent? 2 marks

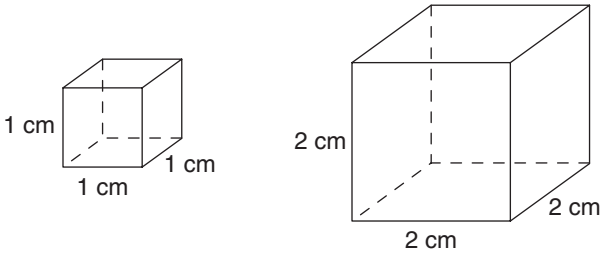
- ii.** Name **one** other type of molecule found in **or** on the membrane **and** outline its function. 1 mark

Cells of the brain, stomach and lungs of mammalian systems are far apart, and yet they are still closely related in terms of the survival of the mammal.

- b.** Explain this statement. 1 mark

Question 3 (9 marks)

Sebastian, a Year 11 Biology student, decided to investigate absorption in roots of plants as his experimental investigation project. In the first part of the project, he cut potato tissue into nine cubes. Eight cubes were 1 cm^3 and one was 2 cm^3 , as shown in the diagram below.



In the second part of the project, Sebastian patted each cube dry on paper towel, weighed them individually and recorded their initial mass. He then placed the eight 1 cm^3 cubes into beaker A, which contained 200 ml of distilled water. He placed the 2 cm^3 cube into beaker B, which also contained 200 ml of distilled water. After 5 minutes, he removed the cubes, patted them dry again and weighed them to record their final masses.

The following table shows the results for the nine cubes before and after immersion in distilled water for 5 minutes.

Cube size	1 cm^3	1 cm^3	1 cm^3	1 cm^3	1 cm^3	1 cm^3	1 cm^3	1 cm^3	2 cm^3
Initial mass (g)	0.62	0.69	0.59	0.63	0.71	0.62	0.58	0.61	1.18
Final mass (g)	1.11	1.25	1.18	1.22	1.29	1.19	1.13	1.09	1.43
Percentage change in mass (%)	44	45	50	48	45	47	48	44	17

- a. Why was it a much better experimental technique to use eight 1 cm^3 cubes rather than only one cube of 2 cm^3 in size? 1 mark

- b. Name and describe the process by which the potato cubes changed mass. 2 marks

- c. Which size cube showed a greater percentage change in mass after 5 minutes? Justify your response. 2 marks

Water is absorbed by the root cells of plants, especially in the root tip area. In this region, the root cells are of a similar size to other cells in the plant, but are structured differently to suit their function of absorption.

- d. Draw a labelled diagram to show how these root cells are well adapted for absorption. 2 marks

- e. Xylem tissue is important for transporting water and dissolved mineral salts upwards in the plant.

State **two** ways in which the xylem vessel cells are different in structure from other cells in the plant's stem **and**, for each, identify how this structural adaptation aids their function in transportation.

2 marks

Question 4 (6 marks)

A significant disadvantage of wastewater treatment plants is their carbon footprint. Researchers have now found a way to reduce carbon emissions from sewage and simultaneously produce useful hydrogen energy. The method uses purple bacteria and electrical currents acting on the organic matter that is flushed down the toilet daily.

Purple bacteria belong to the largest and most diverse group of bacteria. They are phototrophic, using infrared light as the energy source for their metabolism. They are pigmented with bacteriochlorophyll a and bacteriochlorophyll b and other pigments called carotenoids. This results in their colour ranging from brown to red, orange and purple.

- a.** Would these purple bacteria be classified as photosynthetic autotrophs, chemosynthetic autotrophs or heterotrophs? Justify your response using each of the appropriate terms. 2 marks

Most plants and algae are green in colour compared to the purple bacteria.

- b.** Complete the following statement for green plants and algae: 2 marks

Green plants carry out a chemical process in which they capture and convert _____ energy and transform it into _____ energy which is stored in complex molecules of _____. In this process, the by-product of _____ is released.

The purple bacteria being used in biofuel research are placed in three different genera: *Rhodomicrobium*, *Rhodopseudomonas* and *Rhodospirillum*. However, all three are classified in the same family: *Rhodospirillaceae*.

- c. i.** What is the difference between a genus and a family in classification? Explain using the purple bacteria as an example. 1 mark

- ii.** Suggest **one** major advantage of using the same classification system in research programs in science laboratories all over the world. 1 mark

Question 5 (6 marks)

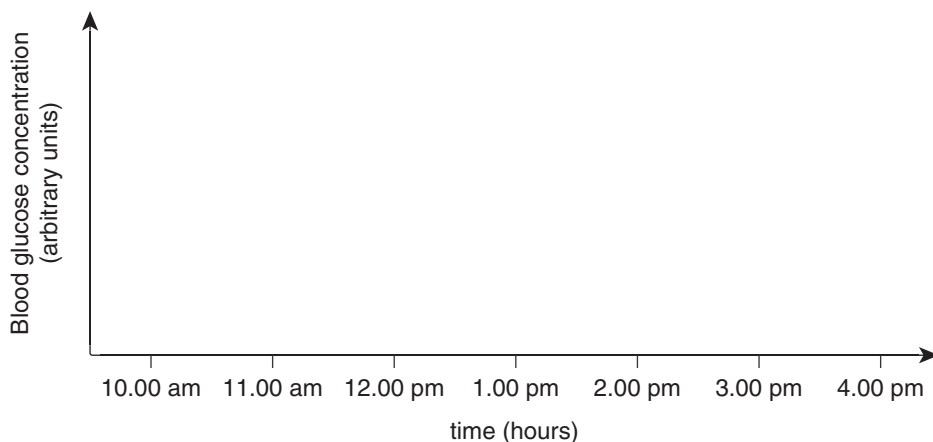
Every day after eating a substantial midday meal of pasta, bread and salad or a pie, chips and a cake, Jeremy would frequently want to lie down for a rest on the couch, saying he felt lethargic and exhausted as his blood glucose was low. He had no diabetic condition and was generally healthy.

Jane, on the other hand, had been diagnosed with Type 1 Diabetes and, after she had consumed her lunch, often felt tired or lethargic. She usually monitored her blood glucose and injected insulin mid-morning. However, on one particular day she forgot to inject insulin at 10.00 am. At 1.00 pm she remembered and injected insulin.

- a. i.** Explain whether Jeremy was correct in claiming his blood glucose was low soon after consuming his lunch. 1 mark

- ii.** Explain whether Jane's lethargy after a midday meal on the day she forgot to inject insulin at 10.00 am was caused by the same factor as Jeremy's lethargy. 1 mark

- b. i.** On the following graph axes, draw a solid line for Jeremy's blood glucose level **and** a dotted line for Jane's blood glucose level during the time period shown on the graph for the day that Jane forgot her 10.00 am insulin injection. 2 marks



- ii.** Give the general term for the process that causes the changes shown by the graph lines drawn above **and** explain how this process operates in blood glucose regulation in the human body. 2 marks

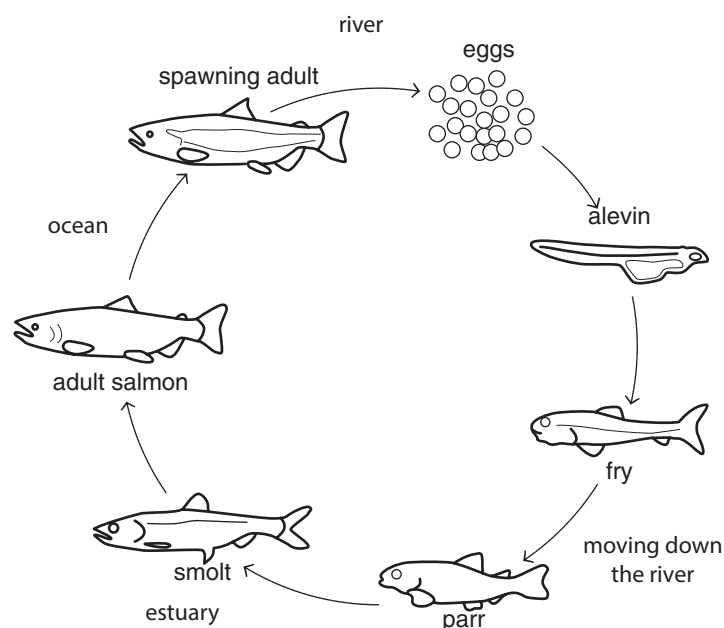
Question 6 (9 marks)

The coastal temperate rainforests of Canada are sometimes called ‘salmon forests’, as salmon nourish these rich, complex terrestrial habitats. Salmon are aquatic, so their relationship with the rainforest is indirect. When salmon die at the end of their life cycle, bears drag their carcasses into the forest where eagles and other birds feed on the rotting fish carcasses. These actions fertilise the forest, including adding an important amount of nitrogen to the soil.

- a. i. What is the difference between aquatic and terrestrial environments? Refer to the salmon and bear in your response. 1 mark

- ii. What term is used for organisms such as the eagles who feed on the rotting fish carcasses? 1 mark

Examine the following diagram of the life cycle of salmon through the river, estuary, ocean and back, as shown by the direction of the arrows.



- b. Suggest **one** physiological adaptation that smolts may display to make them better adapted to the increasingly salty/brackish water environment. 1 mark

In the estuaries where the river and sea water meet, brackish water supports salt-tolerant plants such as eel grass and sea asparagus. Abundant nutrients from the river and sea mix in this region. Plankton are in large quantities in this area. Salmon feed on foods found in amongst the plants, such as small invertebrates and herring eggs as well as small fish. The small fish feed on small invertebrates and plankton.

- c. i.** Use the above information to name the main producers that ‘fuel the estuary food chains’ **and** explain how this estuary environment increases the population density of these organisms. 1 mark

- ii.** Using the above information, draw a possible food web involving the salmon in the estuary environment. 2 marks

- iii.** Explain why the arrows are drawn pointing in the direction shown in your answer to **part c.ii.** 1 mark

- iv.** What is the original source of energy for this food web? 1 mark

- v.** Name **one** organism in the food web above that is found at the third trophic level **and** write the food chain that supports this answer. 1 mark

Question 7 (9 marks)

Dutch and Danish researchers have discovered a ‘horrible fungus’, *Entomophthora muscae*, that lives on houseflies, feeding off them, reproducing inside them and eventually killing them.

A spore from the fungus settles on a housefly, germinates and then infects the fly. The threads of the fungus spread through the body of the fly to its brain, whereby the fungus can manipulate the fly’s behaviour and force it to crawl to the top of a branch. Here it will die with its wings spread to make it more noticeable, while the fungus produces a glue-like substance to stick the fly’s dead body to the branch. The fly’s body is digested and transformed into a mass of fluffy white filaments that are extremely attractive to other houseflies, which then inspect and touch the dead body. Their motion sets off tiny cannon-like fungal stalks with spores on their tips. These spores are sprayed over nearby flies or carried high up into air currents.

- a. i.** What is the name of the relationship between the fungus and the housefly? 1 mark

- ii.** Justify your answer to **part a. i.** In your response, refer to both organisms. 1 mark

- b.** What is the advantage for the fungus by using the cannon-like stalks? 1 mark

The scientific name for the fungus is *Entomophthora muscae*; the name for the housefly is *Musca domestica*. Both names contain ‘musca’ but in different positions in their scientific name.

- c.** Explain the significance and position of the word *muscae/musca* in each of the scientific names. 2 marks

Such impressive projectile weapons as those possessed by this fungus are rarely seen in animals and fungi. Scientists are hopeful that they can build a ‘cannon’ using the principles of the fungus to attack other insect pests. The structure designed uses a rubber-like tube with a minute plastic ‘bullet’ jammed in the top and a syringe to inject water, which builds up pressure to shoot the ‘bullet’.

- d. i.** What is the name of the process, as in the development of the fungal ‘cannon’, that applies to designs inspired from nature to develop inventions that will help to solve human problems? 1 mark

- ii.** Give another example of the process named in **part d.i.** 1 mark

Some people have expressed considerable concern that the use of such techniques could impact enormously on ecosystems. Important insects such as bees, flies and other insects are already decreasing in numbers; figures of decreases up to 40% have been suggested from recent research.

- e. Identify **two** of the crucial roles played by insects in ecosystems that may result in ecosystem collapse if their numbers are markedly decreased. 2 marks

END OF QUESTION AND ANSWER BOOKLET

Trial Examination 2020

VCE Biology Unit 1

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
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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