Student Number _____

MC /20	M1 Mol /19	M2 Mol /9	M3 Brighton /11	M4 Brighton /16	Total /75

Student Name _____

Teacher _____

Sydney Technical High School

2022

PRELIMINARY COURSE EXAMINATION

Biology

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black or blue pen
- Draw diagrams and graphs using pencil
- Approved calculators may be used
- Write your student number in the space provided

Total marks – 75

This paper has two parts, Part A and Part B

Part A – 20 marks
- Attempt Questions 1-20
- Allow about 35 minutes for this part

Part B – 55 marks
- Attempt Questions 21- 31
- Allow about 1 hour and 25 minutes for this part

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Part A – 20 marks
Attempt Questions 1-20
Allow about 35 minutes for this part

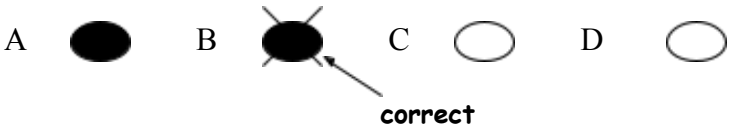
Use the multiple-choice answer sheet.

Select the alternative A,B,C or D that best answers the question. Fill in the response oval completely.

Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.



Student Number _____

PRELIMINARY EXAMINATION

Biology

Multiple Choice Answer Sheet

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 ◯

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Student Number _____

1. What is an advantage of an *open* circulatory system?

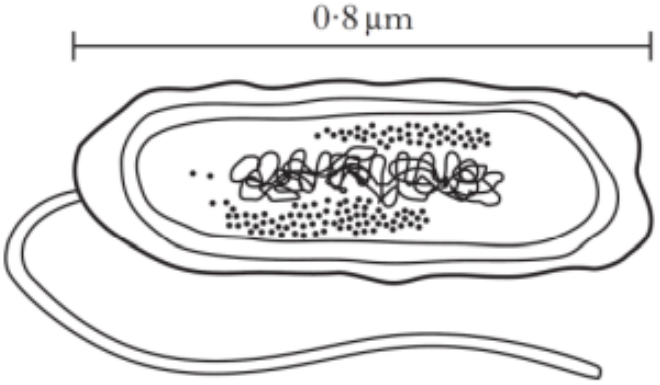
   (A) It uses less metabolic energy.

   (B) It allows organisms to grow larger.

   (C) It enables organisms to move faster.

   (D) It is a more efficient way to move gases, nutrients and water around an organism's body.

2. The following diagram shows a bacterial cell (drawing not to scale).



   What is the length of this cell in millimetres (mm)?

   (A) 0.0008

   (B) 0.008

   (C) 80

   (D) 800

3. Which of the following statements about the nutrient and gas requirements of *autotrophs* is correct?

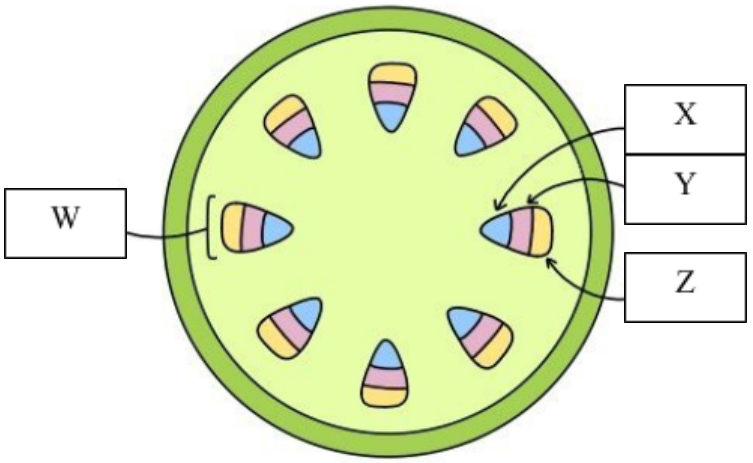
   (A) Glucose is ingested into the digestive system.

   (B) Carbon dioxide gas diffuses into the organism.

   (C) Carbon dioxide gas is not required by the organism.

(D) Oxygen gas diffuses into the respiratory surface.

4. Which is the correct labelling option for the cross-section of a stem, shown below.



	W	X	Y	Z
(A)	Sclerenchyma	Vascular Bundle	Xylem	Phloem
(B)	Vascular Bundle	Xylem	Phloem	Sclerenchyma
(C)	Sclerenchyma	Phloem	Xylem	Vascular Bundle
(D)	Vascular Bundle	Phloem	Xylem	Sclerenchyma

5. Which plant cell organelles can be seen with a light microscope?

(A) Cell wall, nucleus, chloroplast, vacuole

(B) Cell wall, nucleus, mitochondria, vacuole

(C) Cell wall, nucleus, chloroplast, mitochondria, vacuole

(D) Cell wall, nucleus, golgi body, chloroplast, mitochondria, vacuole

6. Which of the following identifies the correct function for each plant structure?

	Structure	Function
(A)	Guard cells	Maximises surface area for the absorption of sunlight.
(B)	Palisade cells	Contain chloroplasts near the upper surface of the leaf to absorb sunlight.
(C)	Spongy mesophyll cells	Provide support as well as a pathway for the movement of water and other products of photosynthesis.
(D)	Stomata	Allows movement of water into the plant by osmosis and mineral ions out of the plant via diffusion.

7. Which statement about enzymes in humans are correct?

(A) at low temperatures enzymes are denatured

(B) at temperatures over 50 °C, enzymes are denatured

(C) fevers inactivate enzymes

(D) fevers denature enzymes

8. Which of the following processes is responsible for the transport of glucose into a cell if the concentration of glucose outside the cell is less than the concentration of glucose inside the cell?

(A) osmosis

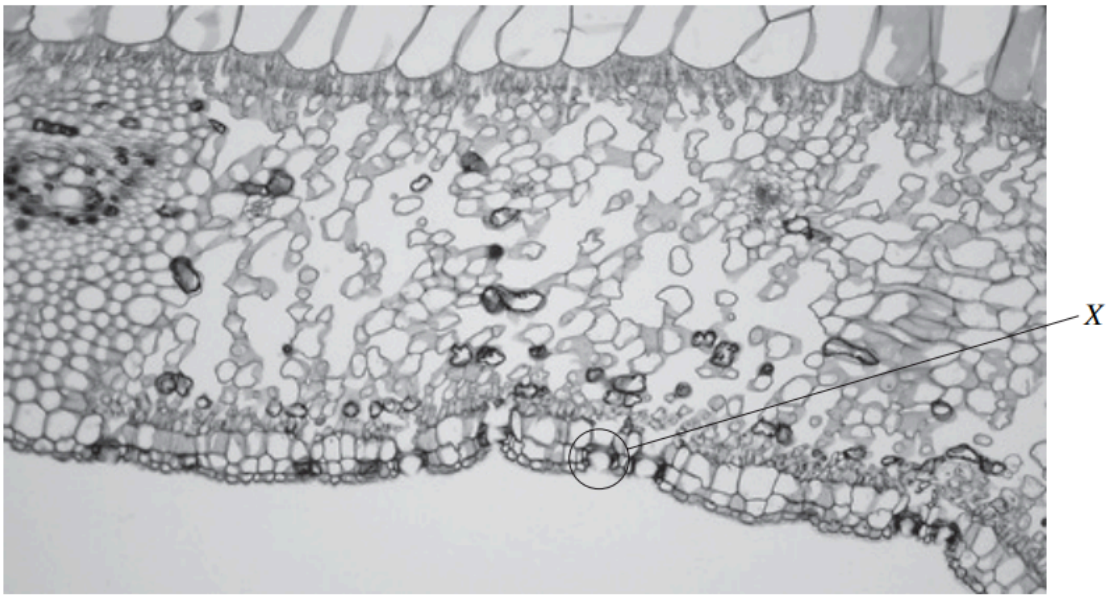
(B) diffusion

(C) passive transport

(D) active transport

Student Number _____

9. The photograph shows a cross section of an angiosperm leaf.



Source: Fayette A and Reynolds M S (14 August 2017), Berkshire Community College Bioscience Image Library. Accessed May 2022. https://www.flickr.com/photos/146824358@N03/36408199682

The function of the structure labelled X is:

(A) diffusion of oxygen and carbon dioxide into and out of the leaf.

(B) photosynthesis.

(C) respiration.

(D) osmosis of water out of the leaf in transpiration.

10. Which statement best describes the process of endocytosis?

(A) A separate membrane vesicle containing materials approaches the cellular membrane and combines with it in order to transport materials into the cell.

(B) A separate membrane vesicle containing materials approaches the cellular membrane and combines with it to transport materials outside the cell.

(C) The cellular membrane forms a capsule around materials that breaks off into a separate membrane vesicle for the transport of substances outside the cell.

(D) The cellular membrane forms a capsule around materials that breaks off into a separate membrane vesicle for the transport of substances into the cell.

11. Which one of the following would not be part of an organism's ecological niche?

(A) The time they feed.

(B) Their function within the environment.

(C) Where they live.

(D) How long they live.

12. Differences in structure that represent anatomical modifications from a common ancestor indicate how organisms have evolved to become different. This is called:

(A) evolution.

(B) convergent evolution.

(C) divergent evolution.

(D) natural selection.

13. Selection pressures act on traits in the population which results in some traits becoming more common while others become less common.

Which of the following is an example of a selection pressure?

(A) Abundance of territory.

(B) Competition for mates.

(C) Lack of food.

(D) All of the above.

14. Old man saltbush has leaves which are covered by a thick waxy cuticle to reduce water loss and it is able to tolerate high levels of salt in the soil - hence 'saltbush'.

Which of the following correctly identified these adaptations respectively?

(A) Physiological and behavioural

(B) Structural and physiological

(C) Physiological and structural

(D) Structural and behavioural

15. Which statement is most accurate?

(A) Biodiversity is the degree of variation between individuals in a variety of different species living within an ecosystem.

(B) The environment is the abiotic components of the ecosystem, including temperature, water availability and nutrient availability.

(C) The community is the sum of all the living organisms in a place at a particular time; for example, the algae, coral polyps, fish, sharks, sea snails, shellfish and sea stars on a coral reef.

(D) Topography refers to the arrangement of the size and shape of human-made features of a specific area of Earth.

16. Unicellular algae called zooxanthellae live within the bodies of marine invertebrates, including sponges, jellyfish, sea anemones, corals, gastropods and turbellarians. The photosynthetic activity of these algal cells is vital to the survival of the individual coral animals and to the entire reef ecosystem.

What type of interaction is represented by this information?

(A) allelopathy

(B) predation

(C) mutualism

(D) parasitism

17. Which abundance sampling method should be used if the population to be investigated is a plant species thought to be scattered over a large area (400 km^2) and its numbers too large to be counted directly?

(A) Capture-recapture

(B) Direct count

(C) Line transects

(D) Quadrat sampling

18. Which of the following only include abiotic factors?

(A) Light, population, temperature, rainfall

(B) Light, salinity, pH, oxygen availability

(C) Substrate, water movement, predation, pH

(D) Predation, pathogens, grazing pressure

19. The following diagram shows the early stages of development of three vertebrate species, a chick, a rabbit and a human.

Which evidence for evolution does this represent?

(A) Biogeography

(B) Comparative anatomy

(C) Comparative embryology

(E) Molecular Biology

20. Which of the following is an example of speciation?

(A) A group of birds migrate to a new area to seek food. They reproduce and populate the new area. Over many generations they keep reproducing.

(B) One individual bird is moved to a new area. This bird finds a closely related bird to mate with. They reproduce and their offspring is a new species.

(C) A flood separates a population of a flightless bird species. They have a new environment to live in. They survive and reproduce in a new area. Their offspring are a new species.

(D) A population of a flightless bird species becomes geographically isolated from its original population. Over time, new traits are favoured that are best suited to their new environment. Over many generations, this population of bird is no longer able to breed with the original population of bird.

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Part B – 55 marks
Attempt Questions 21 –31

Allow about 1 hour and 25 minutes for this part
Answer the questions in the spaces provided.
Show all relevant working in questions involving calculations.

Module 1	Marks

Question 21 (4 marks)
Construct a table to compare the processes of photosynthesis and respiration

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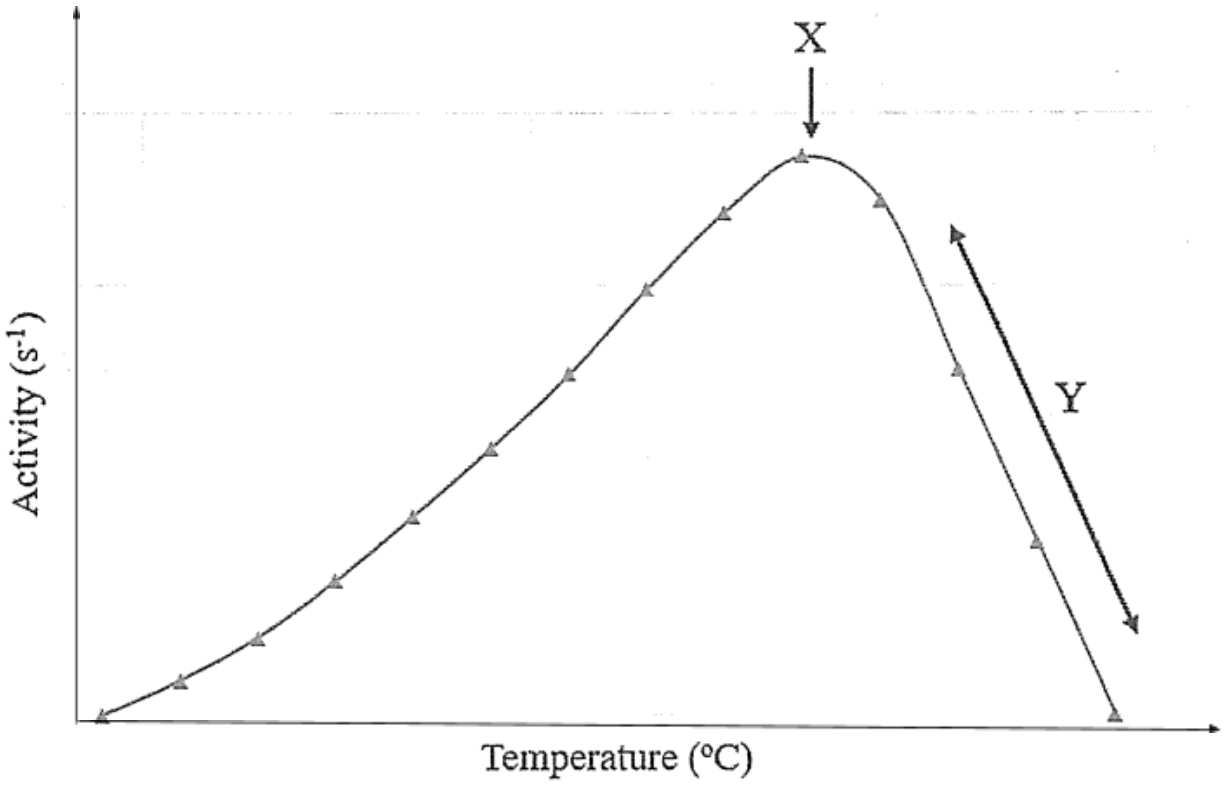
Questions continue over the page.

Question 22 (4 marks)

A practical investigation determined the effect of environmental factors on the activity of an enzyme activity. Only one environmental factor was changed, and results are plotted on the graph below.



(a) Identify the aim of this experiment. **1**

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(b) Using the graph and the labels X and Y, explain the change in enzyme activity when changing this one environmental factor. **3**

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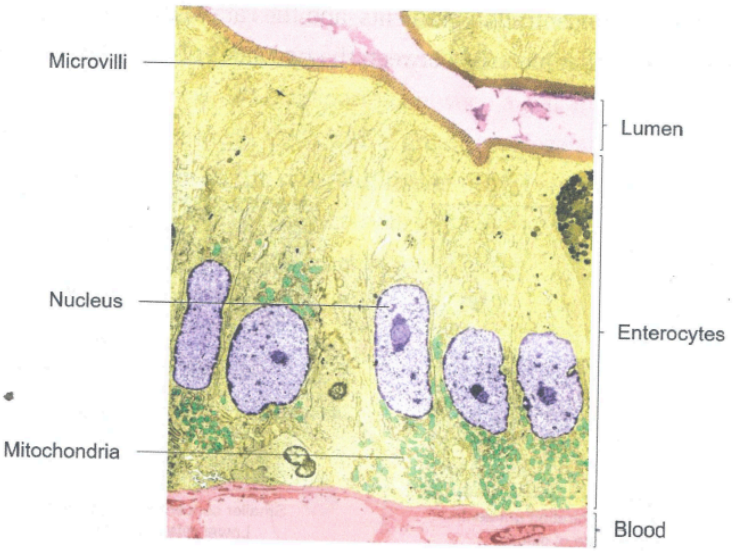
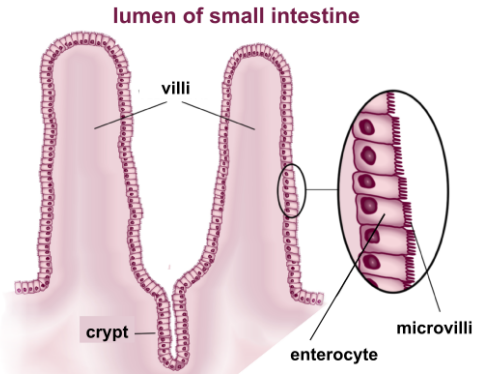
Question 23 (11 marks)

The diagrams below show a Transition Electron Micrograph (TEM) of a section of the epithelium in the small intestine and a schematic of the structure of the lumen.





Materials diffuse from the lumen, through enterocytes and into the blood during digestion.

The cell membrane is comprised primarily of molecules called phospholipids.

(a) Draw a labelled diagram of a cell membrane showing the arrangement of phospholipids. **3**

Questions continue over the page.

(b) Explain the different processes of passive and active transport used to move materials in and out of the cell. **4**

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(c) The table below shows the concentration of sodium ions in the lumen, enterocytes, and blood.

	Lumen	Enterocyte	Blood
Concentration (mmol/L)	80	15	140

State and explain whether the diffusion of sodium ions from the lumen into enterocytes is a passive or active process. **2**

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(d) Explain how the structure of the specialised enterocyte cell is suited to its function. **2**

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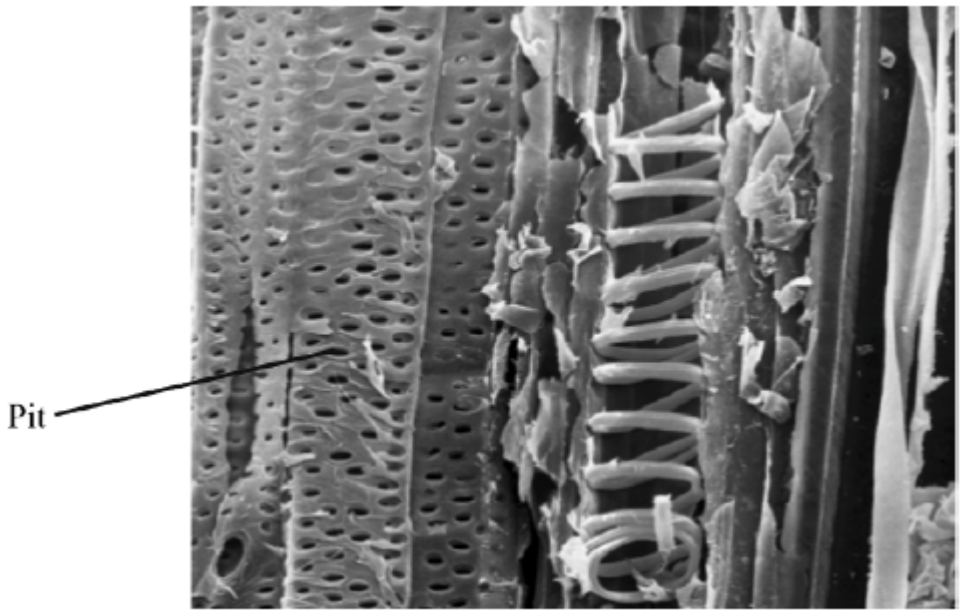
Questions continue over the page.

Module 2	Marks

Question 24 (4 marks)

Xylem vessels are produced from non-xylem cells in meristematic tissue.
The diagram below shows an electron micrograph of xylem tissue.



(a) State the function of the pits in xylem tissue. **1**

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(b) Xylem forms part of a plant's transport system.
Explain why large multicellular plants need a transport system. **3**

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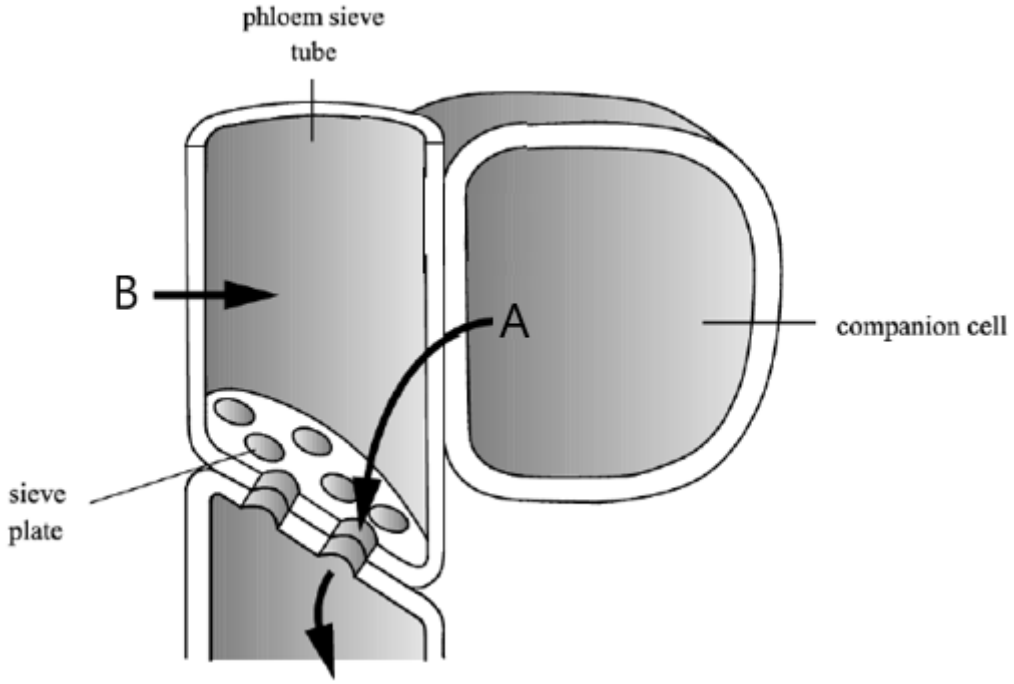
Question 25 (5 marks)

Plants use translocation to move sugars around the organism.

With reference to the figure below, explain the process of the loading of sucrose into phloem and its movement in the phloem.



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Question 21-25 Extra writing space.

If you use this space clearly indicate which questions you are answering.

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Questions continue over the page.

Module 3	Marks

Question 26 (5 marks)

Biologists Peter and Rosemary Grant conducted long term studies of the evolution of Darwin's finches on the Galapagos Islands. They measured the beak depth of birds over a 40-year period, during which time the island experienced severe drought which killed many of the finches.

The results of their studies for the years 1976 (before the drought) and 1978 (after the drought) are shown in the graphs below.

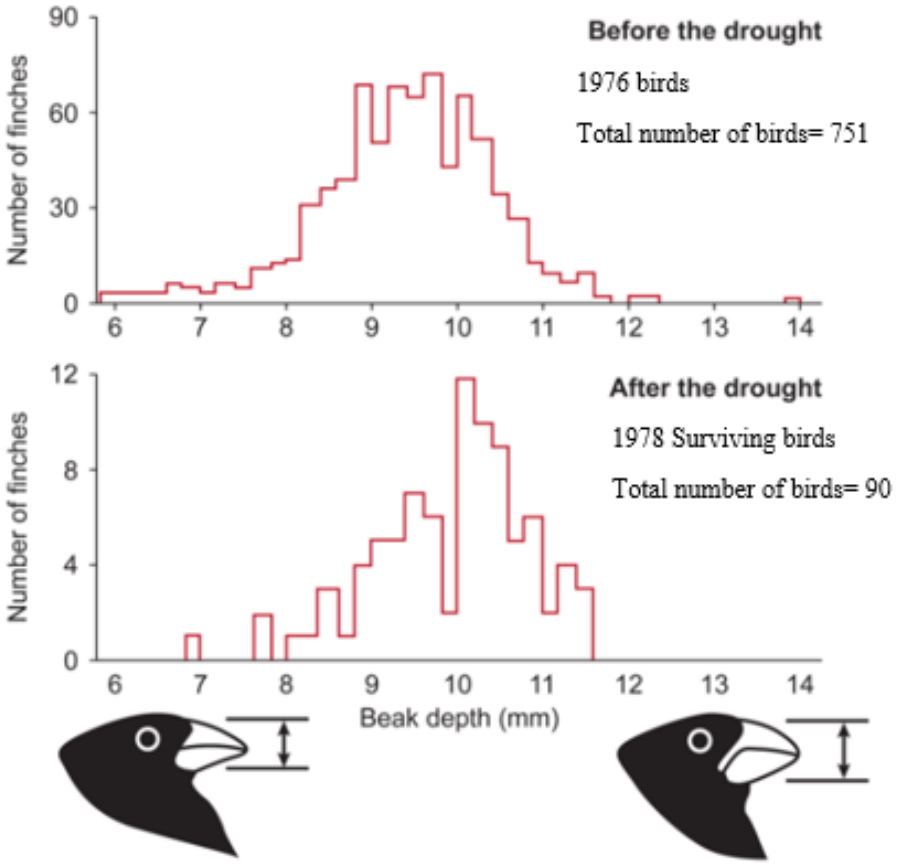

Image: UC Museum of Paleontology Understanding Evolution, www.understandingevolution.org

Question continued on the next page

Question continued from the previous page

Explain how Darwin's finches evolved using the main principles of the Theory of Evolution by Natural Selection.

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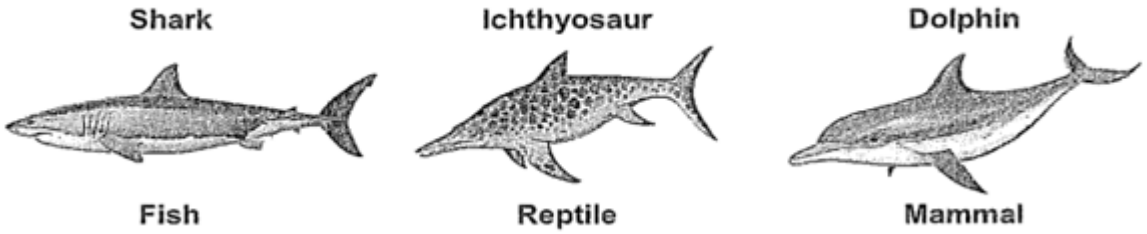
Question 27 (4 marks)

Each animal below looks outwardly very similar, but the three are from different classes in animal classification. It has been suggested that each animal evolved separately over a long period of time, in a similar environment.



(a) What process is this an example of? **1**

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(b) How does the fossil record provide evidence to support the concept of punctuated equilibrium? **2**

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(c) What is the main limitation when using the fossil records in making inferences about ancestry? **1**

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Question 28 (2 marks)

Describe an example of how comparative anatomy is used as evidence to support the Theory of Evolution.

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Student Number _____

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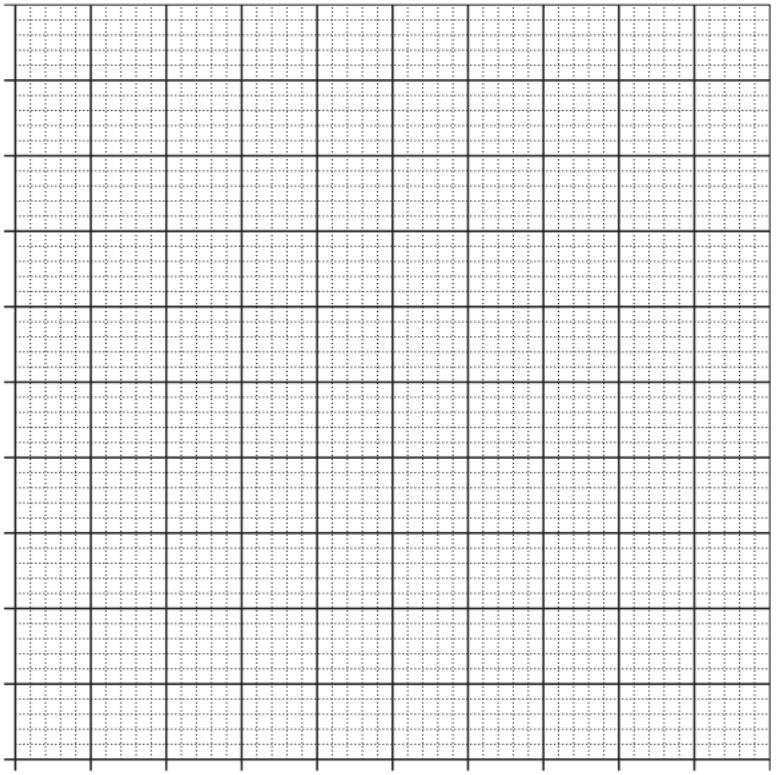
Module 4	Marks

Question 29 (8 marks)

Blanding's turtles (*Emydoidea blandingii*) are medium-sized turtles that are native to the Great Lakes and midwestern United States. Some of their key characteristics are their yellow necks and dark shells, and they feed on crayfish, snails, and insects. Their population has been declining due to a variety of factors. Scientists have been tracking a population of Blanding's turtles in a wetland preserve outside of Chicago, IL since 1970, and recently the data has been made available to the public.

Year	**Blanding's Turtle Population**
1970	198
1975	205
1980	230
1985	201
1990	153
1995	92
2000	51
2005	29
2010	15
2015	9

(a) Create a line graph that shows the change in population of Blanding's turtles over time. **4**



(b) Discuss the role of two human-induced selection pressures on the reduction in the Blanding's turtle population size. **4**

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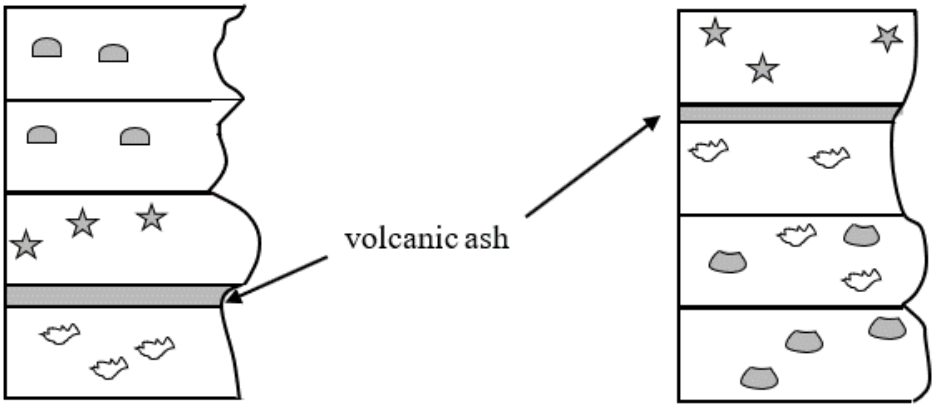
Questions continued on the next page

Question 30 (5 marks)

The diagrams below show geological sections from two nearby excavations, and some of the fossil species discovered.

The volcanic ash deposits are the same age and come from the same eruption.



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sea urchin

brachiopod

limpet

starfish

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Question 31 (4 marks)

Analyse paleontological and geological evidence that can be used to provide evidence for past changes in ecosystems.

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END OF EXAM

Question 26-31 Extra writing space.

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