Student Name: _____

BH AdF ELa ELy ASt PG RR AS/LT

Pymble Ladies' College

Year 11 Biology

Preliminary Examination

2022

Time allowed 2 hours + 5 mins Reading Time

Instructions:

This paper is in two parts, worth a total of 90 marks.

Section A	15 one-mark multiple choice questions.
Section B	Questions 16 – 27, written response questions worth a total of 75 marks.

- Multiple choice questions are to be answered on page 25. This may be removed from the paper.
- All Section B questions are to be answered in the space provided.
- If you need extra space, indicate clearly on the relevant question and complete your answer in the extra writing space on page 24.
- Write in blue or black pen only
- The lined spaces in the question booklet are a guide to the expected length of your answer.
- Please write your name and circle your teacher's initials on the front page and on the multiple choice answer sheet.

Section A

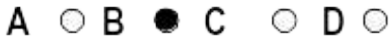
Total marks 15

Attempt Questions 1 – 15

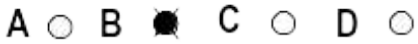
Use the multiple-choice answer sheet (provided).

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

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

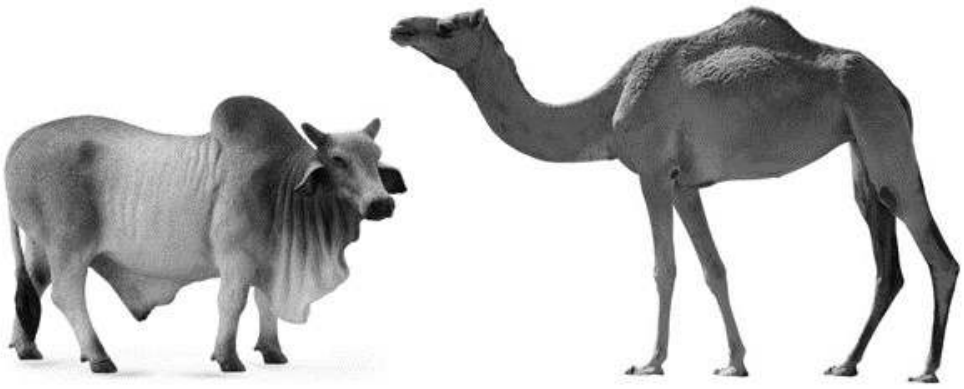


If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.



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

Questions 1 and 2 refer to the pictures of a brahman bull and a camel, below.



1. Both the brahman bull and the camel carry a large proportion of their fat reserves in a hump. This allows them to more effectively lose excess heat in hot dry environments.

   This is an example of:

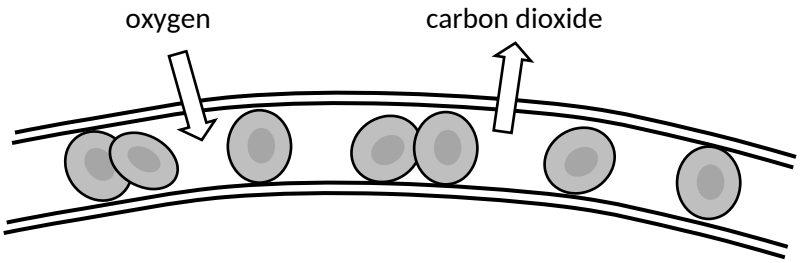
   A. Common ancestry.
   B. Adaptive radiation.
   C. Divergent evolution.
   D. Convergent evolution.

2. Camels can conserve water by concentrating their urine to a much greater extent than most other mammals.

   This is an example of a:

   A. Structural adaptation.
   B. Behavioural adaptation.
   C. Physiological adaptation.
   D. Psychological adaptation.

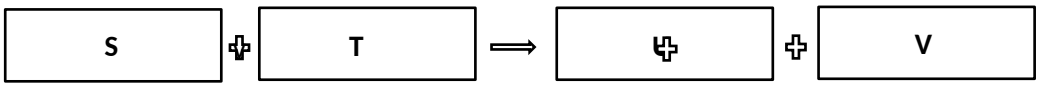
3. The diagram below shows a capillary passing through an organ in the human body.



   Identify the organ.

   A. Heart.
   B. Lungs.
   C. Active muscle.
   D. Small intestine.

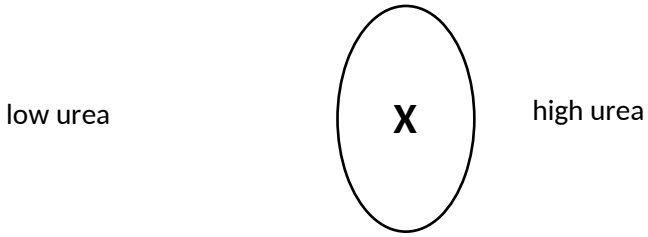
4. The letters below represent the chemical reactants and products in the process of photosynthesis.



Choose the row below which correctly identifies them.

	S	T	U	V
A.	light	carbon dioxide	energy	oxygen
B.	carbon dioxide	oxygen	glucose	water
C.	carbon dioxide	water	glucose	oxygen
D.	light	oxygen	water	energy

5. The diagram below shows how the urea concentration of blood changes as it flows through organ X.



Identify organ X.

A. Liver.
B. Lungs.
C. Kidney.
D. Small intestine.

Question 6 refers to the table below, which shows how the haemoglobin of three different primates differs from that of humans.

Primate	Number of amino acids different from human haemoglobin
Chimpanzee	0
Gorilla	1
Rhesus monkey	8

6. Which one of the following assumptions underpins the interpretation of biochemical evidence of this sort?

   A. All organisms are biochemically the same.
   B. Biochemical similarities reflect genetic similarities.
   C. Biochemical similarities reflect physical similarities.
   D. Biochemical similarities between species are evidence of cross-breeding.

7. Cleaner wrasses ***(Labroides spp.)*** are a group of closely related fishes which live by picking and eating parasites from the gills of large reef fish.

   Occasionally a cleaner wrasse will actually bite off and eat gill tissue from its host.
   This represents a change from:

   A. Mutualism to parasitism.
   B. Mutualism to competition.
   C. Parasitism to commensalism.
   D. Commensalism to mutualism.

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. Active transport.
   D. Passive transport.

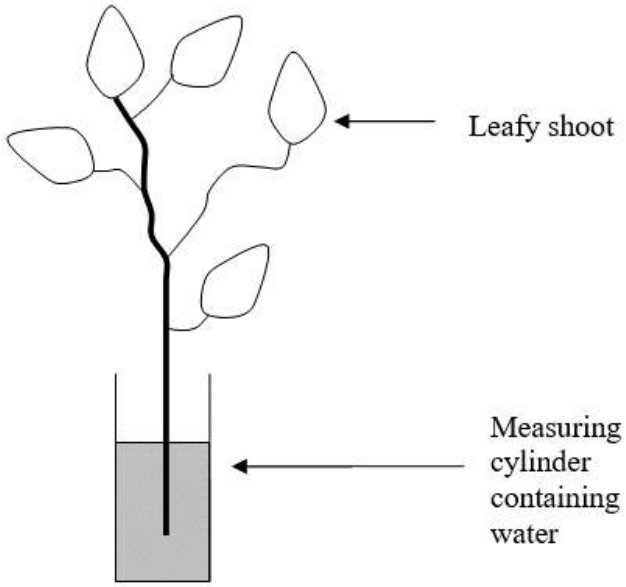
9. Which factor limits the maximum size of a cell?

   A. The materials needed to build it.
   B. The amount of food it needs to survive.
   C. The number of organelles that can be packed inside.
   D. Its need for enough surface area for exchange of materials with its environment.

Questions 10 to 11 refer to the diagram below.

The diagram shows the experimental set-up for a first-hand investigation testing the following hypothesis.

The higher the air temperature the greater the rate of transpiration.



The results of the investigation are shown below.

Air temperature (°C)	**Volume of water transpired in one hour (mL)**
15	0.8
20	1.1
25	1.5
30	1.9
35	2.2

10. What is the independent variable in this investigation?

A. Time.
B. Air temperature.
C. Transpiration rate.
D. Volume of water transpired.

11. Which one of the following variables would most need to be controlled in this experiment?

A. Air humidity.
B. Air temperature.
C. Same measuring cylinder.
D. Volume of water transpired.

12. The photomicrograph below is of a cell organelle.

Which one of the following best describes its function?

A. Photosynthesis.
B. Protein synthesis.
C. Aerobic respiration.
D. Packaging proteins for export from the cell.

13. The six-plated barnacle (*Chthamalus antennatus*) is a common species on NSW rocky shores.

In many areas it forms a distinct band on the upper shore. Its upper limit is determined by its ability to avoid drying out, naming due to exposure to the sun and time out of the water. Its lower limit is determined by the presence of predators and competitors.

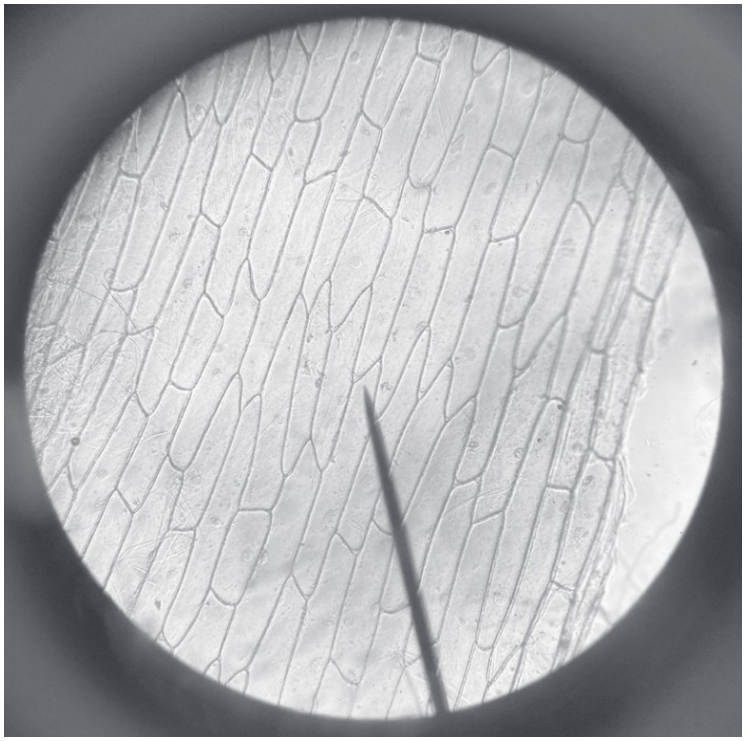
Choose the row which best describes the type of factors determining the limit.

	Factors determining upper limit of distribution	**Factors determining lower limit of distribution**
A.	abiotic	biotic
B.	abiotic	abiotic
C.	biotic	abiotic
D.	biotic	biotic

14. The rate at which substances enter and leave a cell is determined by several factors. Two of those factors are:

A. Molecule size and temperature.
B. Concentration and molecule size.
C. Surface-area-to-volume ratio and cell size.
D. Temperature and surface-area-to-volume ratio.

15. A photograph of onion epidermis under a monocular light microscope is shown.



Source: Reproduced with permission from Litchfield C (2021), Onion epidermis [photograph].

Which of the following cell components can be identified in the photograph?

A. Cell wall and nucleus.
B. Nucleus and mitochondria.
C. Chloroplast, nucleus and cell wall.
D. Cell wall, nucleus and mitochondria.

Section B

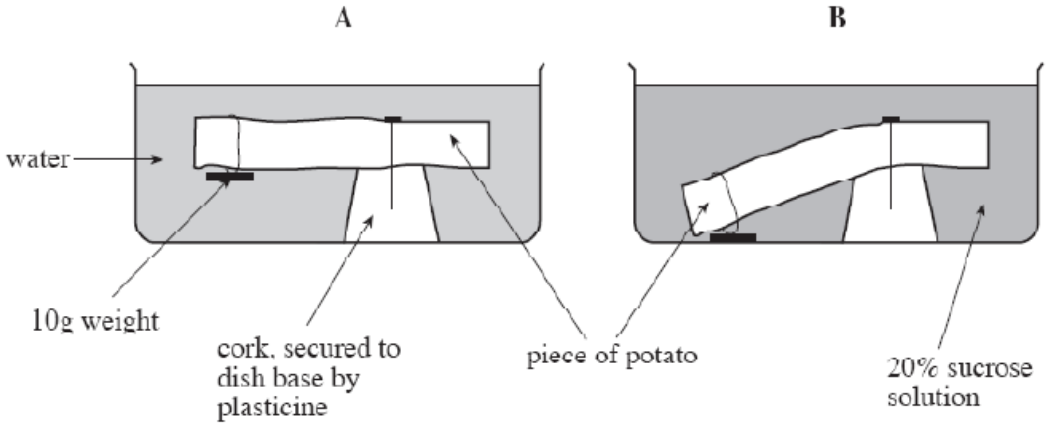
Total marks 75

Answer Questions 16 - 27 in the space provided

Question 16 (3 marks)

The diagram shows two potato cylinders after they have been left for 24 hours in different solutions.

At the beginning of the experiment, they both looked like diagram A.



Explain, in terms of water movement, why B is different to A. **3**

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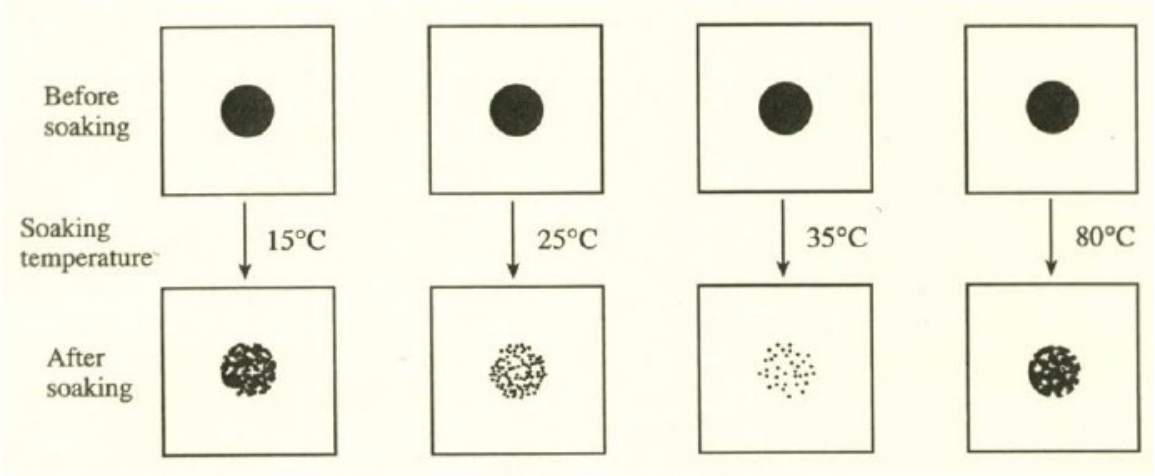
Question 17 (7 marks)

Biological washing powders contain enzymes. A student carried out an investigation with biological washing powder as follows:

- Four pieces of material were stained with egg, which is mainly protein and fat.
- Each piece of material was then soaked in a solution of the biological washing powder for 15 minutes.
- The four pieces of material were soaked at different temperatures as shown in the diagram below.
- This investigation was repeated four times and the average result is shown in this diagram.



a) State THREE factors other than time which should be kept constant in this investigation. **3**

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b) From the results, which temperature would you recommend for use with this washing powder? **1**

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c) Using your understanding of enzymes explain the reason for your choice. **3**

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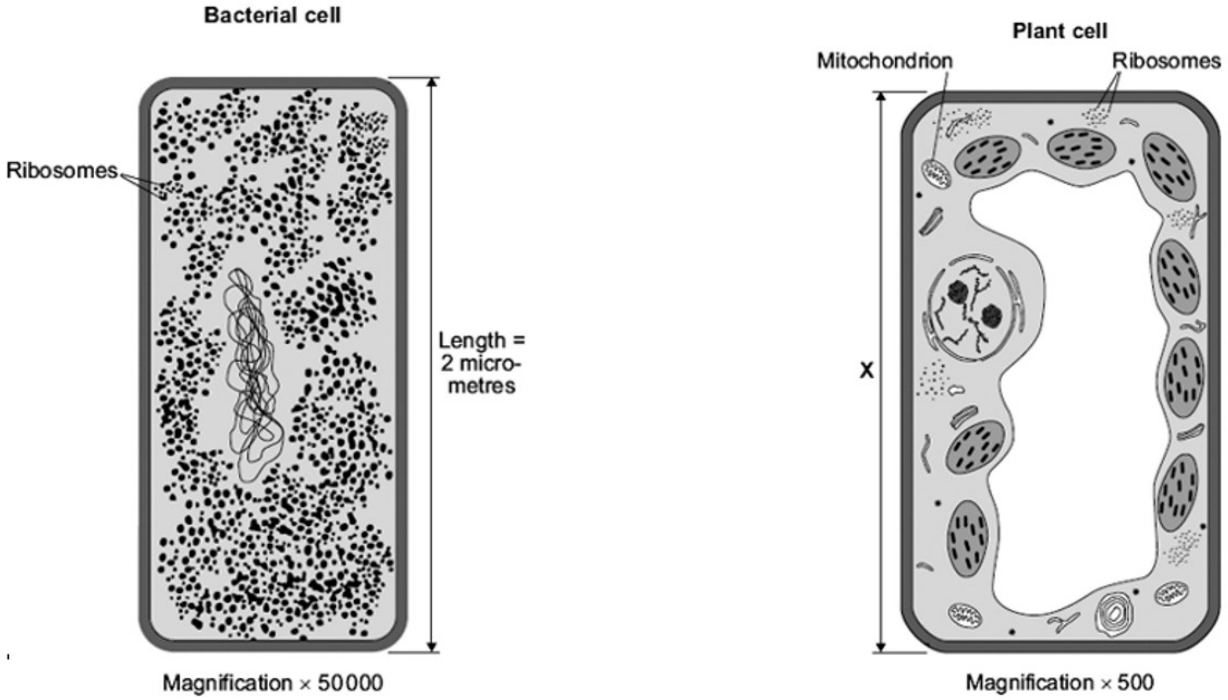
Question 18 (13 marks)

The diagram below compares a prokaryotic cell with a eukaryotic cell.



a) State which cell is a prokaryote. **1**

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b) Describe TWO differences between a prokaryotic cell and a eukaryotic cell. **2**

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c) The diagram indicates the size of each cell. Explain which cell is smaller. **3**

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Question 18 continues on the next page

d) The presence of ribosomes is a similarity between both the prokaryotic and eukaryotic cells. Describe the role of ribosomes in a cell. **2**

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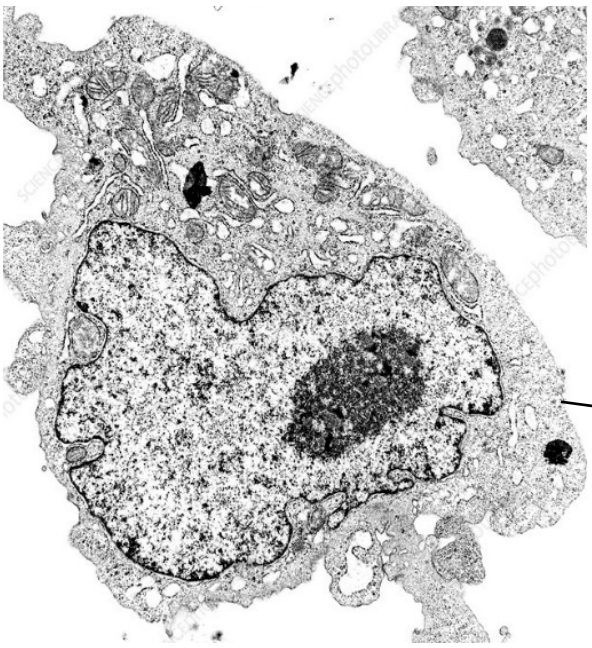
e) Shown below is a micrograph of an animal cell. In the space below, draw a scientific diagram of this cell and label THREE organelles, not including the cell membrane. **5**



Magnification x16,000

Question 19 (4 marks)

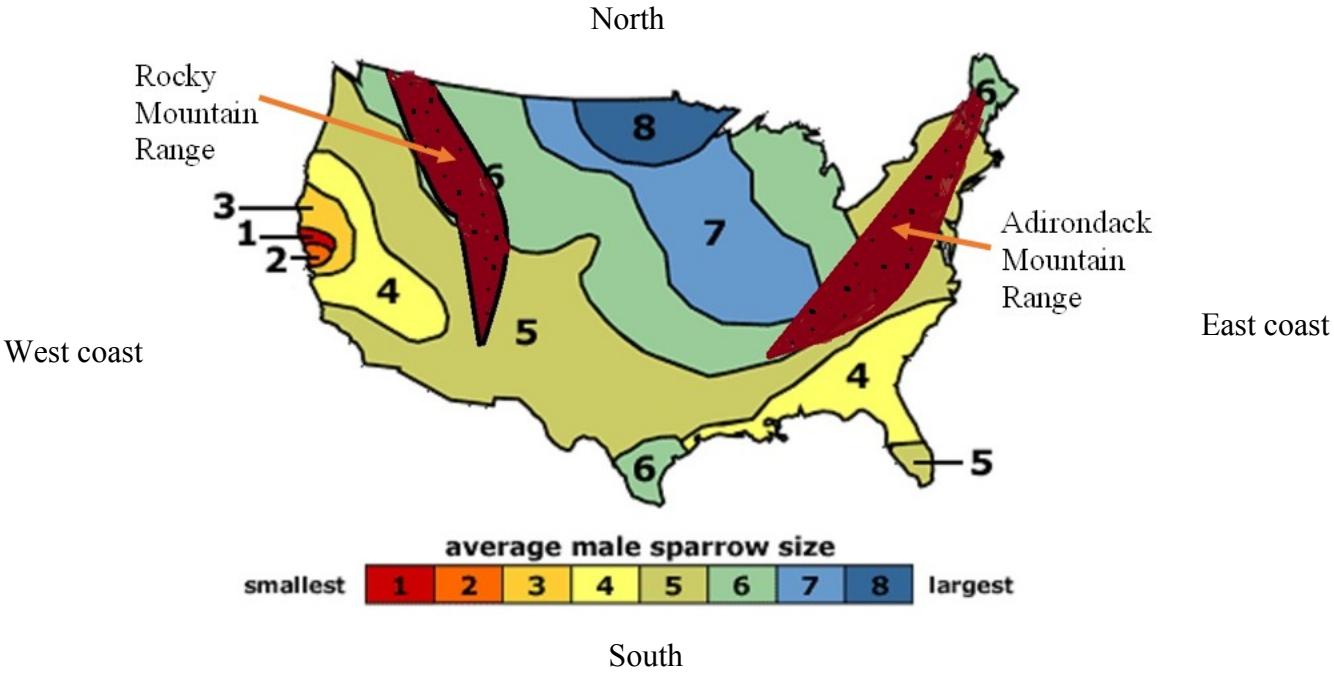
Cells are composed of water, inorganic ions, and carbon-containing (organic) molecules. Most of these organic compounds belong to one of four classes of molecules: carbohydrates, lipids, proteins, and nucleic acids.
Classify each of the following as carbohydrates, lipids, proteins or nucleic acids.

Glucose, canola oil, animal muscle, DNA, animal fat, starch, insulin, haemoglobin, cellulose.

Present the information in a table. **4**

Question 20 (7 marks)

The map shows the distribution of house sparrows by size in the USA. Since the time that they were first introduced to North America in the 1850s, the sparrows have evolved different characteristics in different locations. As this map shows, sparrows in colder northern areas are now generally larger than sparrows in warmer regions (in the south and on the west coast).



Sparrow map adapted from Gould, S.J & Johnston, R.F. (1972) Geographic Variation. Annual Review of Ecology and Systematics. 3:457-498

a) With reference to Darwin's Theory of Natural Selection, explain the change that has occurred in the sparrow populations. **4**

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Question 20 continues on the next page

b) The locations of the Rocky and Adirondack Mountain ranges are shown on the map.
With reference to the data, predict what is likely to happen to sparrow populations on either side of these mountain ranges over time and give reasons for your prediction. **3**

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Question 21 (4 marks)

During your study of Biology, you have investigated a range of plant and animal cells. Using a specific example of a plant OR animal cell, describe its function, and outline the features that make it well suited to its role.

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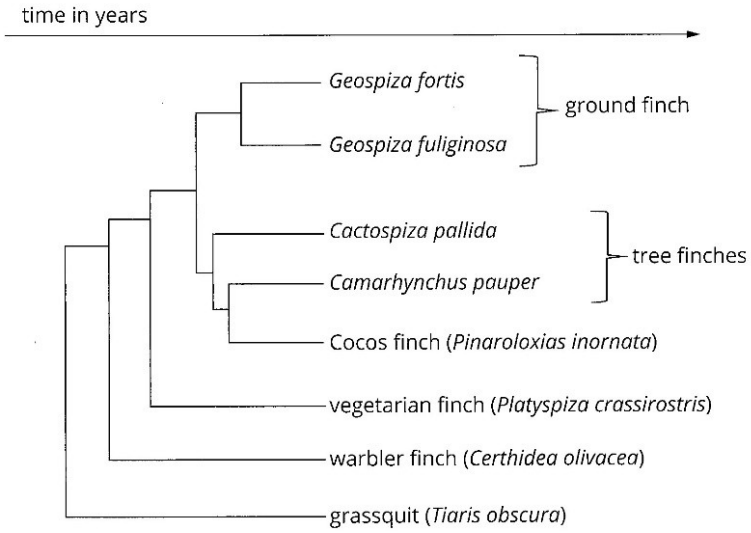
Question 22 (6 marks)

The following diagram shows a phylogenetic tree (evolutionary tree) of Darwin's finches based on evidence from DNA studies.



a) Based on this phylogenetic tree, identify which finch would you expect to be most different from the other finches.

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b) Outline a technique that uses DNA to identify relationships between species. **2**

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c) Explain how evidence from DNA studies supports the theory of evolution. **3**

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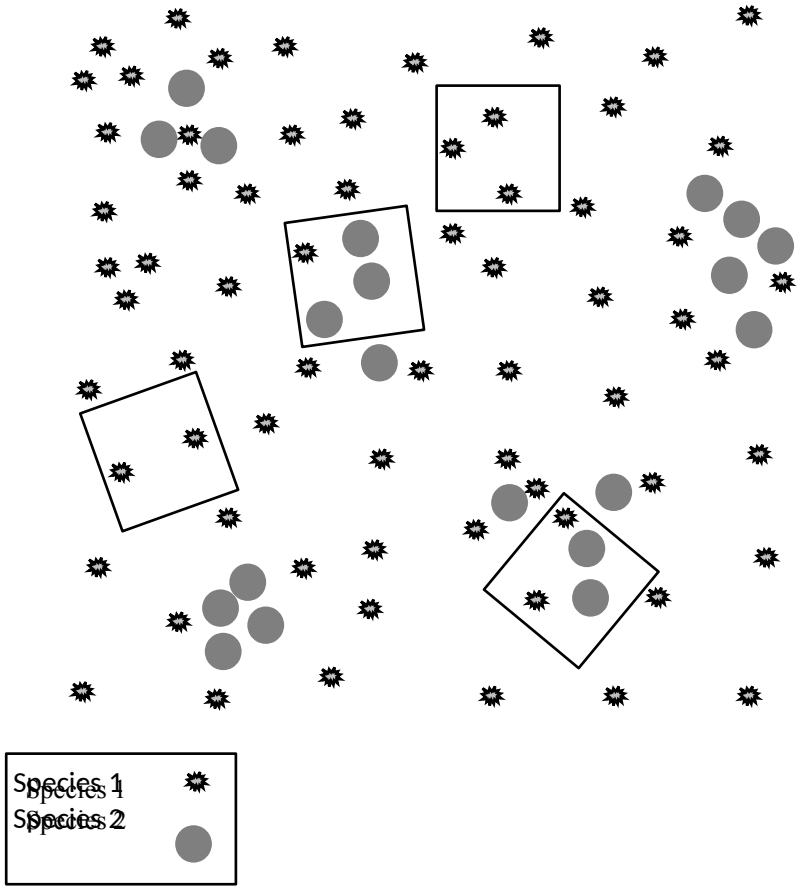
Question 23 (4 marks)

Some ecologists are studying the distribution of some introduced plant weed species in an area of grassland.
The map below shows the distribution of two introduced plant species in a sample area of the grassland.
The ecologists have placed four 1m x 1m quadrats randomly.



a) Using these quadrats calculate the population density, in plants/m^2, of each species (show your working). **2**

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b) During their research, the ecologists decided that the quadrat method provided a more valid measurement of population density of Species 1 than Species 2. Describe why this is. **2**

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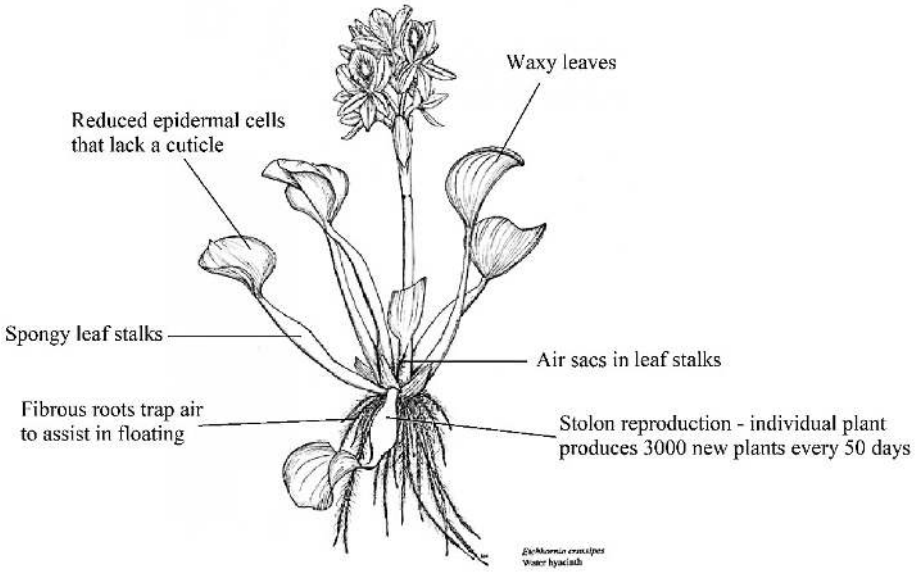
Question 24 (7 marks)

The water hyacinth (*Eichhornia crassipes*) is an invasive plant species that inhabits a variety of freshwater environments throughout the world, including Australia. It grows a dense, thick mat over water bodies.



a) Using the diagram above, identify one physiological adaptation of the water hyacinth. **1**

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b) Outline how specific adaptations assist the water hyacinth in invading freshwater environments. **2**

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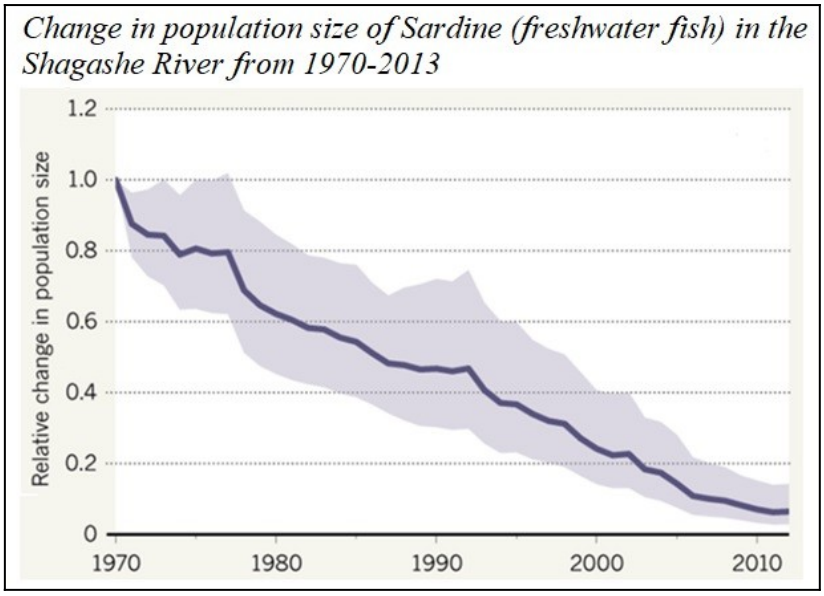
Question 24 continues on the next page

The table and graph below show some of the impacts of the water hyacinth on both abiotic factors and fish populations in the Shagashe River, Zimbabwe.

Effect of water hyacinth on abiotic factors in the Shagashe River.

Parameter	**Water hyacinth infestation**	**No water hyacinth infestation**
Turbidity (NTUs)	29.75	16.89
Water temperature (˚C)	31.18	29.32
Dissolved Oxygen (mg/L)	1.72	5.67



Socio-Ecological Impacts of Water Hyacinth (Eichhornia Crassipes) Under Dry Climatic Conditions: The Case of Shagashe River in Masvingo, Zimbabwe. Chapungu L, Mudyazhezha OC and Mudzengi B (2018)*

c) With reference to the data provided, explain the reduction in the freshwater fish population in the Shagashe River. **4**

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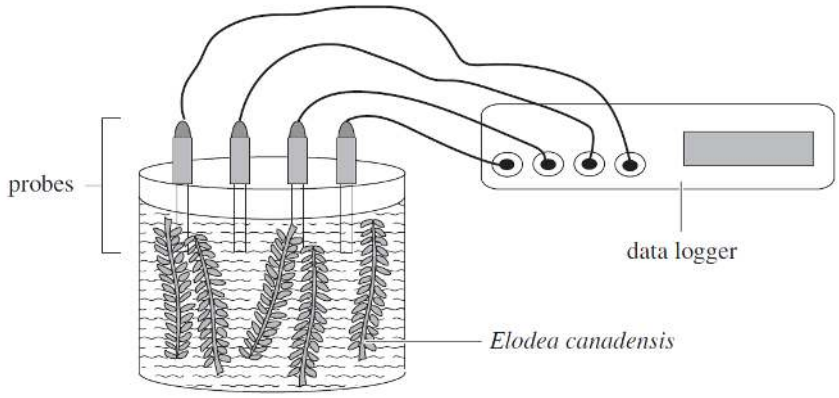
Question 25 (10 marks)

A student investigated the change in abiotic factors in a water tank containing elodea pondweed (*Elodea canadensis*) and set up their experiment as shown in the diagram.



Data was recorded over a 24-hour period using a light probe, a pH probe, an oxygen probe, a temperature probe and a data logger. The student's results are shown in the table.

Time (hour)	Light (Lux)	pH	Oxygen (% Saturation)	Temperature (°C)
10:00	600	3.57	96.2	22
12:00	1000	4.09	98.5	22.7
14:00	877	4.33	99.5	23.3
16:00	135	4.45	94.8	23.3
18:00	0	3.50	88.5	21.3
20:00	0	3.80	99.2	21.9
22:00	0	3.22	68.3	20.3
0:00	0	3.35	78.1	20.7
2:00	0	3.12	53.4	19.6
4:00	0	3.18	59.7	19.8
6:00	167	3.10	48.1	19.3
8:00	1000	3.22	63.4	21.2
10:00	1000	3.75	87.6	24.5

Question 25 continues on the next page

a) Graph the data to show the pH change in the water tank over the 24-hour period. **3**

b) Outline the trend in the graph from part a). **1**

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c) When carbon dioxide is dissolved in water, carbonic acid is formed. As the concentration of dissolved carbon dioxide increases, the acidity increases and the pH of the water decreases.
Using your knowledge of photosynthesis and respiration, explain the pH curve from part a) over the 24-hour period. **4**

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Question 26 continues on the next page

d) The oxygen level (% saturation) in the water tank was lowest before dawn (6am). Account for this finding

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Question 26 (4 marks)

Compare the respiratory systems of a human and an insect. **4**

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Question 27 (6 marks)

Transport systems are essential for the efficient functioning of multicellular organisms.

Justify this statement with reference to both plants and animals. **6**

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End of examination

Extra Writing Space (please indicate clearly which question you are continuing in this space)

Student Name:_____

KB AdF ELa ELy NS SH RR AS/LT

Pymble Ladies' College

ANSWER SHEET: SECTION A

2022 BIOLOGY PRELIMINARY EXAMINATION MULTIPLE CHOICE

Start Here

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 ⬭