PENRITH SELECTIVE HIGH SCHOOL

PRELIMINARY BIOLOGY 2022

YEARLY EXAMINATION

General Instructions

- Working time – 2 hours
- Reading Time – 5 minutes
- Write using black pen. Answers written in pencil may be disqualified from review
- Diagrams and graphs are to be completed in pencil.
- Marking guidelines for certain questions may be based on question deconstruction and use of a coherent and logical progression of argument

Weighting: 30%

Students will be conducting a practical investigation.

Part A

Multiple Choice -15 marks

Part B

Free Response questions- 55 marks

Total Marks: 70

TOTAL MARKS
FACULTY USE ONLY

Student Number ……..

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PART A- MULTIPLE CHOICE

Attempt Questions 1-15
Allow about 15 minutes for this part
Use the multiple-choice answer sheet for questions 1-15

Question 1

What is the function of the cell membrane?

a) To control the substances that enter and leave the cell
b) To carry out respiration
c) To contain the genetic material
d) To synthesise proteins

Use the following picture to answer questions 2-3

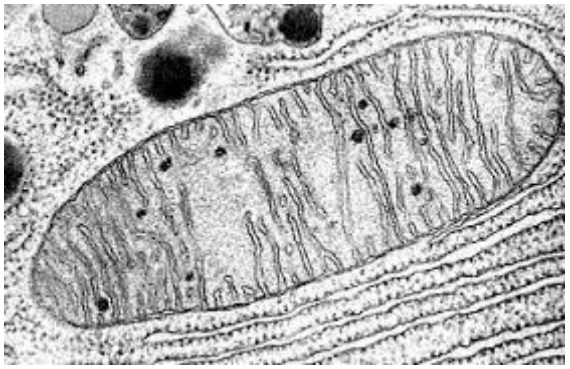


Figure 1:https://www.biology-pages.info/C/CellularRespiration.html

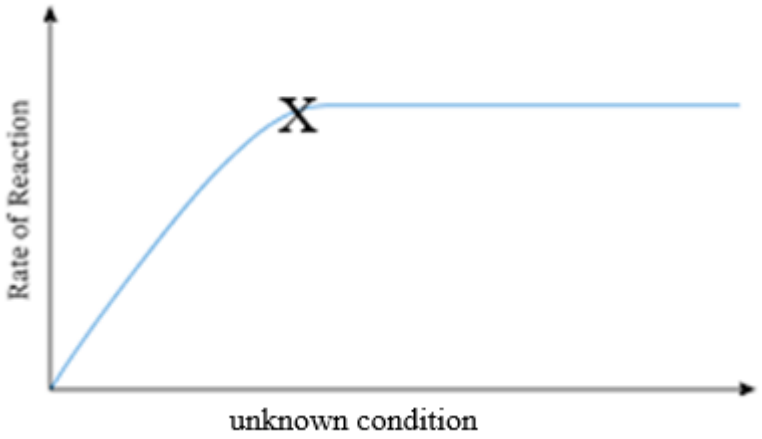
Question 2

The image was produced by a
a) Light microscope
b) X-ray
c) Scanning electron microscope
d) Transmission electron microscope

Question 3

The organelle pictured is the:
a) Nucleus
b) Mitochondria
c) Chloroplast
d) Golgi apparatus

Use the following picture to answer questions 4-5



Question 4

The graph shows the rate of reaction for an enzyme under an unknown condition. What is the unknown condition?

a) Temperature
b) Substrate concentration
c) Surface area
d) pH

Question 5

What is point X known as?

a) Point of saturation
b) Denaturation point
c) End of reaction
d) Optimal point

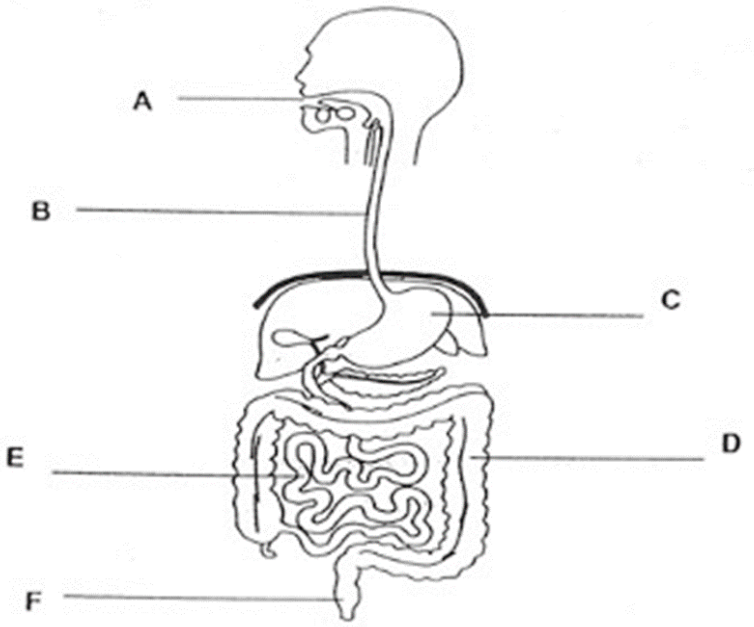
Question 6

Which conditions would lead to the greatest transpiration rate?

a) Cool, sunny day, no clouds, dry soil
b) Warm, dry, windy day, moist soil
c) Cloudy day, no wind, moist soil
d) Rainy day with strong winds

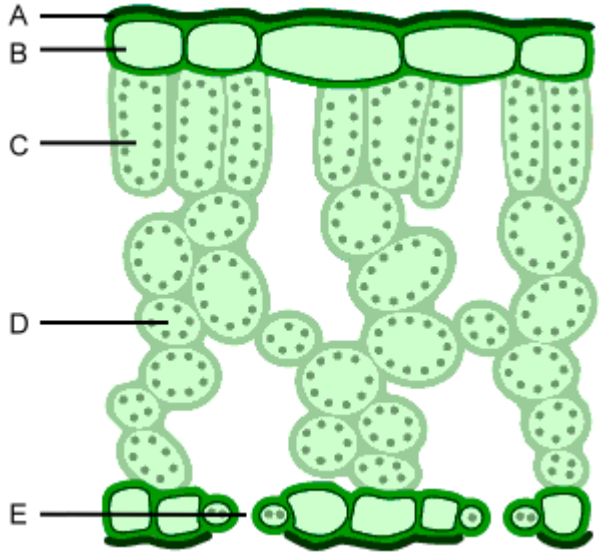
Question 7

Consider the diagram of the human digestive system below.



	A	B	C	D	E	F
a)	Mouth	Trachea	Stomach	Large intestine	Small intestine	Anus
b)	Salivary gland	Oesophagus	Liver	Caecum	Appendix	Rectum
c)	Mouth	Oesophagus	Stomach	Large Intestine	Small Intestine	Rectum
d)	Buccal cavity	Gullet	Diaphragm	Colon	Jejunum	Anus

Question 8
Consider the diagram of a cross-section of a leaf below



What is the correct identification of letters A-E.

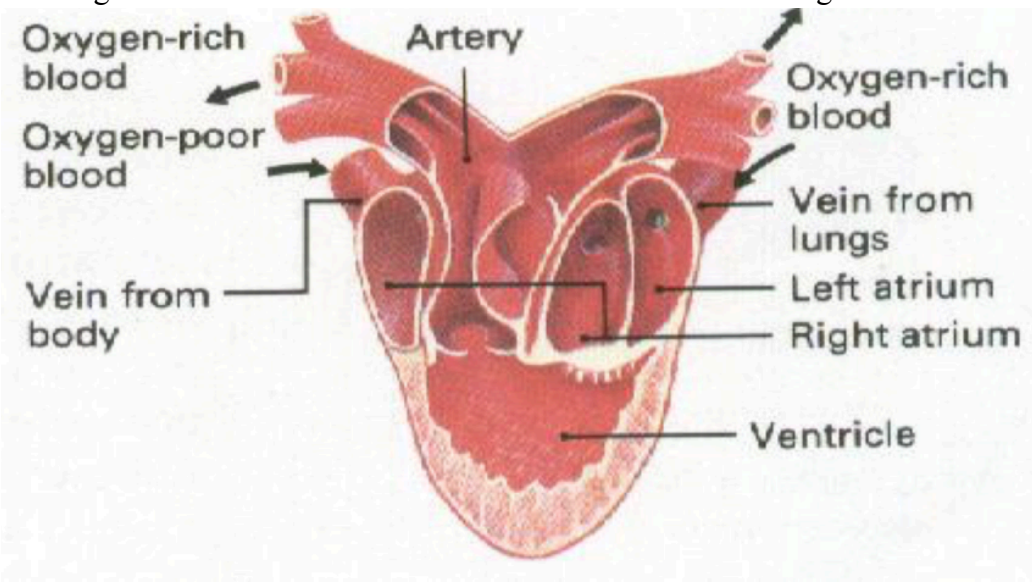
	A	B	C	D	E
a)	Waxy cuticle	Spongy epidermis	Pallisade mesophyll	Open mesophyll	Lower epidermis
b)	Upper epidermis	Spongy mesophyll	Pallisade mesophyll	Air space	Stomate
c)	Waxy cuticle	Upper epidermis	Pallisade mesophyll	Spongy mesophyll	Stomate
d)	Leaf coat	Chloroplast	Spongy epidermis	Xylem vessel	Source cell

Question 9
Mechanical digestion is brought about by;

a) Teeth, tongue and stomach muscles
b) Peristalsis and pancreatic juice
c) Colon, ileum and duodenum
d) Bile, hydrochloric acid and saliva

Question 10

The diagram below shows external and internal features of a frog heart.



One significant difference between a frog heart and a human heart is;

a) Blood in arteries in a frog heart travels towards the heart.
b) Deoxygenated blood in frog hearts is brought from the lungs.
c) Frog hearts have only one ventricle.
d) The main tissue in frog hearts is cardiac muscle.

Question 11

Biological field work often requires the estimation of population size for a prey species. One method that is used is to capture, mark and release and then recapture. If the method of marking reduced the camouflage colour of the species, what effect would this likely have on the population estimate obtained?

a) Recapture numbers will be increased and the population size will be overestimated.
b) Recapture numbers will be increased and the population size will be underestimated.
c) Recapture numbers will be decreased and the population size will be overestimated.
d) Recapture numbers will be decreased and the population size will be underestimated.

Question 12

Which of the following is an abiotic selective pressure on organisms in an ecosystem?

a) Predator population increase.
b) Bacterial infection.
c) Introduction of a parasitic fungus.
d) Increased rainfall.

Question 13

Charles Darwin collected many specimen samples, data and observations to support his Theory of Evolution by Natural Selection.

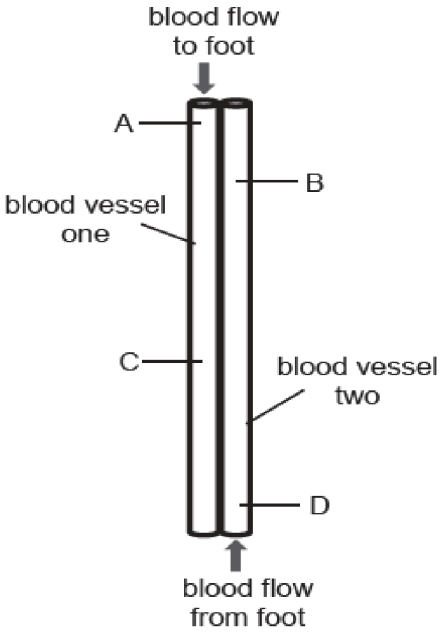
Which of the following is NOT a piece of evidence that he used to support his theory?

a) Biochemical similarities.
b) Comparative anatomy.
c) Galapagos Island finches
d) Australian flora and fauna

Question 14
Which of the following organisms would be least likely to be found in fossil form?

a) Frog
b) Jellyfish
c) Beetle
d) Pine tree

Question 15
Birds that live in cold environments have a counter-current heat exchange system in their legs which is shown in the diagram below.



The temperature of the blood is lowest at point

a) A
b) B
c) C

d) D

PART B- FREE RESPONSE

Attempt Questions 16-24
Allow about 1 hour and 15 minutes for this part

Question 16

The following experiment was set up in a laboratory. The students placed Elodea (an aquatic plant) in a test tube of water with snails and placed them under lights so that photosynthesis may occur. The indicator bromothymol blue was added to each test tube; the indicator is initially blue but will change to green when a small amount of carbon dioxide is present and yellow in the presence of a large amount of Carbon Dioxide.

A picture of the setup is shown below.

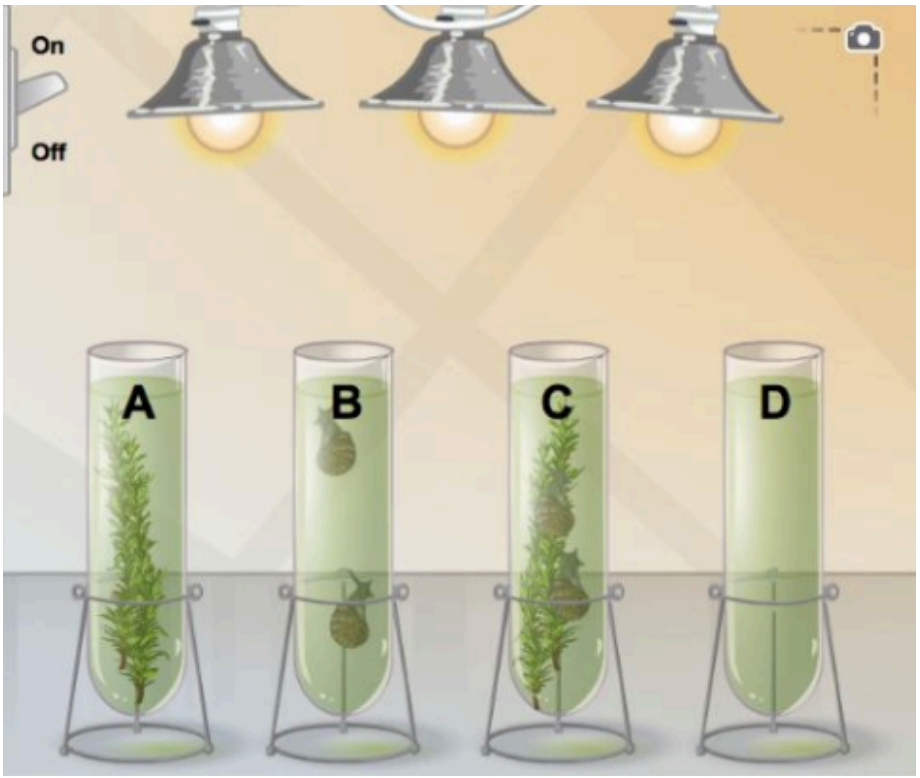


Figure 2: Test tubes with different conditions; snails and elodea virtual lab. source: https://gizmos.explorelearning.com/index.cfm?method=cResource.dspDetail&resourceID=641

Test Tube	***Condition***
A	Elodea only (2 Sprigs)
B	Snails only (2 snails)

C	Snails and Elodea (2 of each)
D	No Elodea and No Snails

After 24 hours the results were collated into the following table

Test Tube	***Observations***	***Colour***	***Oxygen (ppm)***	***Carbon Dioxide (ppm)***
A	Elodea present and alive	Blue	12	0
B	Snails dead	Yellow	1.8	10.2
C	Elodea and snails alive	Green	5.5	6.5
D	No changes	Green	6	6

a) Which test tube was the control group? **1m**

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b) Explain how this experiment shows that snails undergo cellular respiration. Include a word equation to support your answer. **3m**

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Question 17

Below are 2 models representing enzyme function.

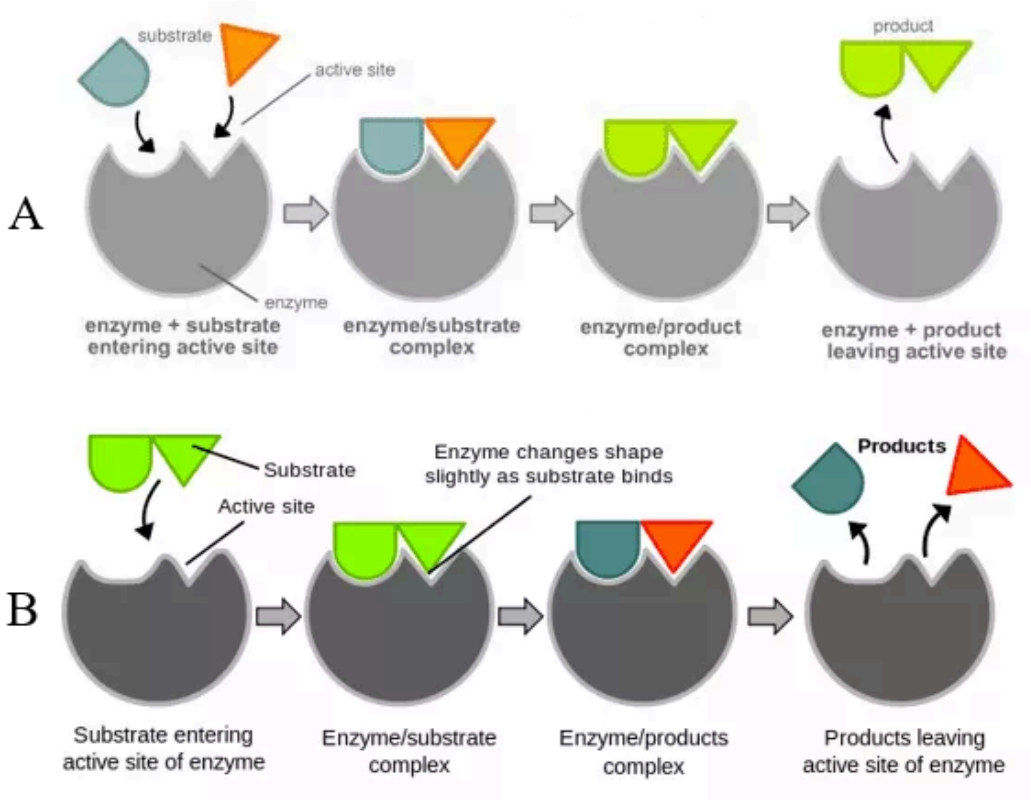

Figure 3: Models representing enzyme function. source: https://alevelbiology.co.uk/notes/biological-catalysts-enzymes/

a) Identify each type of model: **1m**

A: ……

B:……

b) With reference to specificity, explain how enzymes work. **4m**

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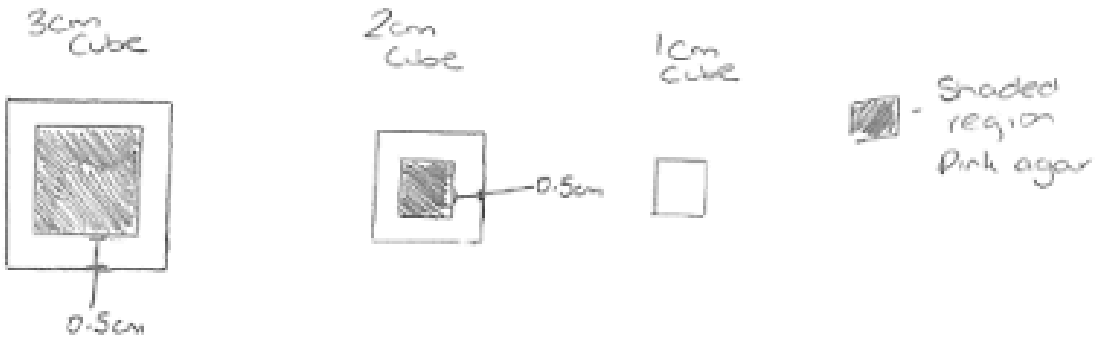
Question 18

A student placed the cubes into a solution of hydrochloric acid. The cubes are made of Agar mixed with indicator phenolphthalein. The cubes were left for the same amount of time, then removed and sliced in half (pictured below).

Figure 4: diffusion and osmosis in cells. source: http://biologywithmrsh.weebly.com/makeup-labs/lab-7-diffusion-and-osmosis-in-cells

The students' results are drawn below.



a) Complete the table. **4m**

Cube size	***Total volume (cm^3)***	***Surface area (cm^2)***	***Unpenetrated volume (pink region) (cm^3)***	***% Penetrated***
3				

2				
1				

QUESTION 18 CONTINUED OVER PAGE

b) Which cube had the highest SA:V **1m**

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c) If the agar cubes were living cells and the hydrochloric acid was a vital nutrient, which cube would have the most efficient ratio of surface area to volume? Explain why. **3m**

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Question 19

The diagram below summarises the movement of materials in vascular plants.

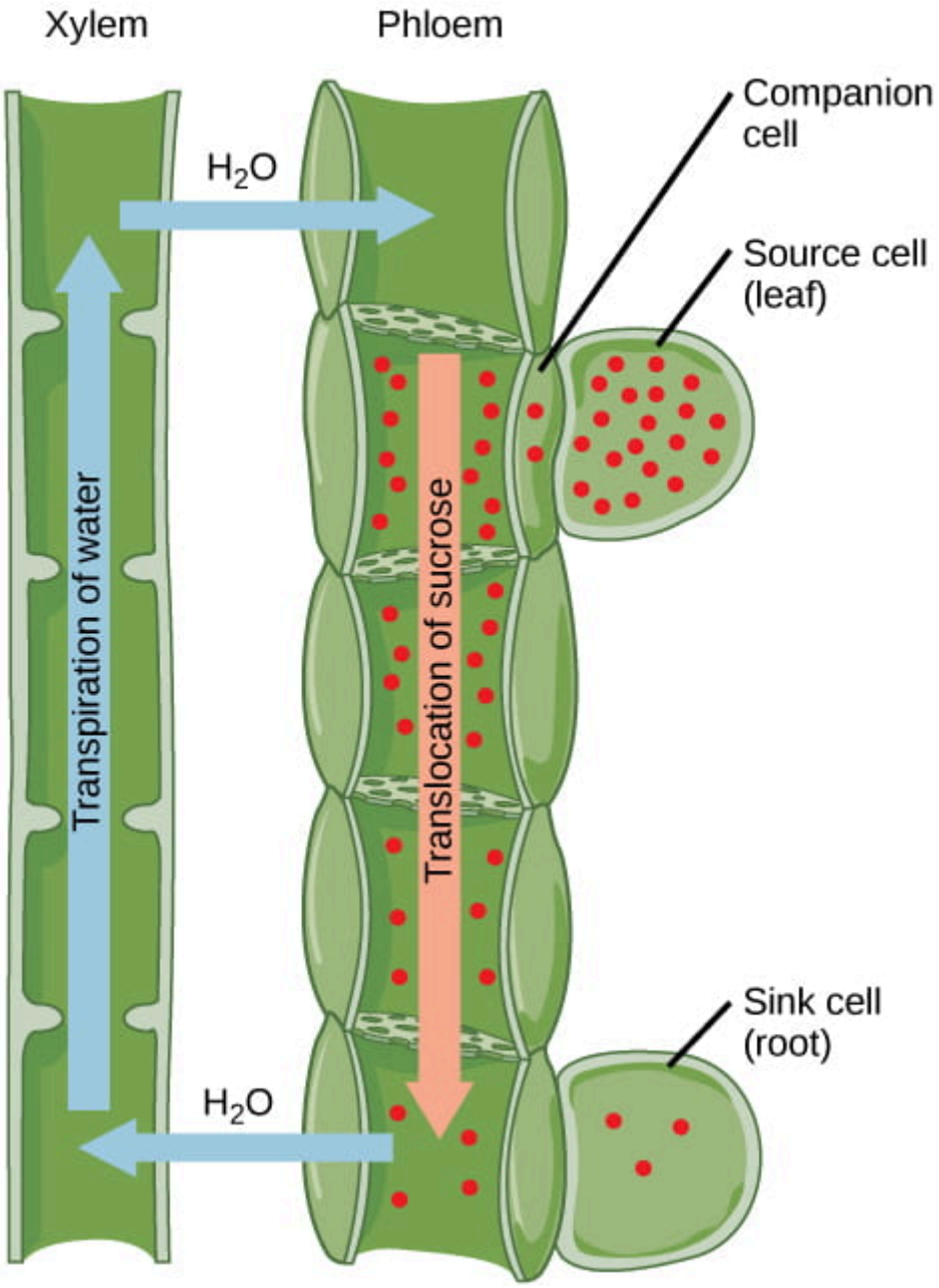

Figure 5:Diagram showing movement of water and sucrose in vascular plants. Source: https://organismalbio.biosci.gatech.edu/nutrition-transport-and-homeostasis/plant-transport-processes-ii/

a) Name the vessel in which translocation of sugar occurs. **1m**

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b) Explain how transpiration leads to the upward movement of water in plants. **4m**

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c) Why does water move into the xylem vessel near a sink cell but out of the xylem vessel near a source cell? **3m**

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Question 20

The image shows a light microscope image of blood vessels.

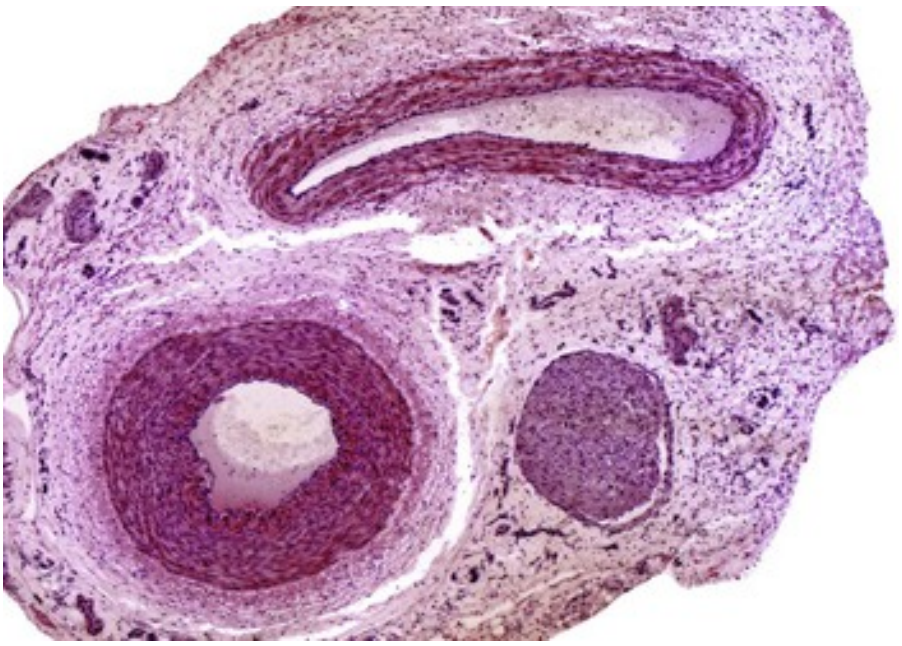

Figure 6: Artery and Vein under light microscope. Source: https://courses.lumenlearning.com/suny-ap2/chapter/structure-and-function-of-blood-vessels/

a) Label one artery and one vein on the image. **2m**

b) Compare the structure and function of arteries and veins. **4m**

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Question 21

"The human respiratory system is obviously better than a bee's respiratory system."
Anonymous Biology student, 2020.

Assess the accuracy of this statement, providing appropriate details of mammal and insect respiratory systems to support your response. **7m**

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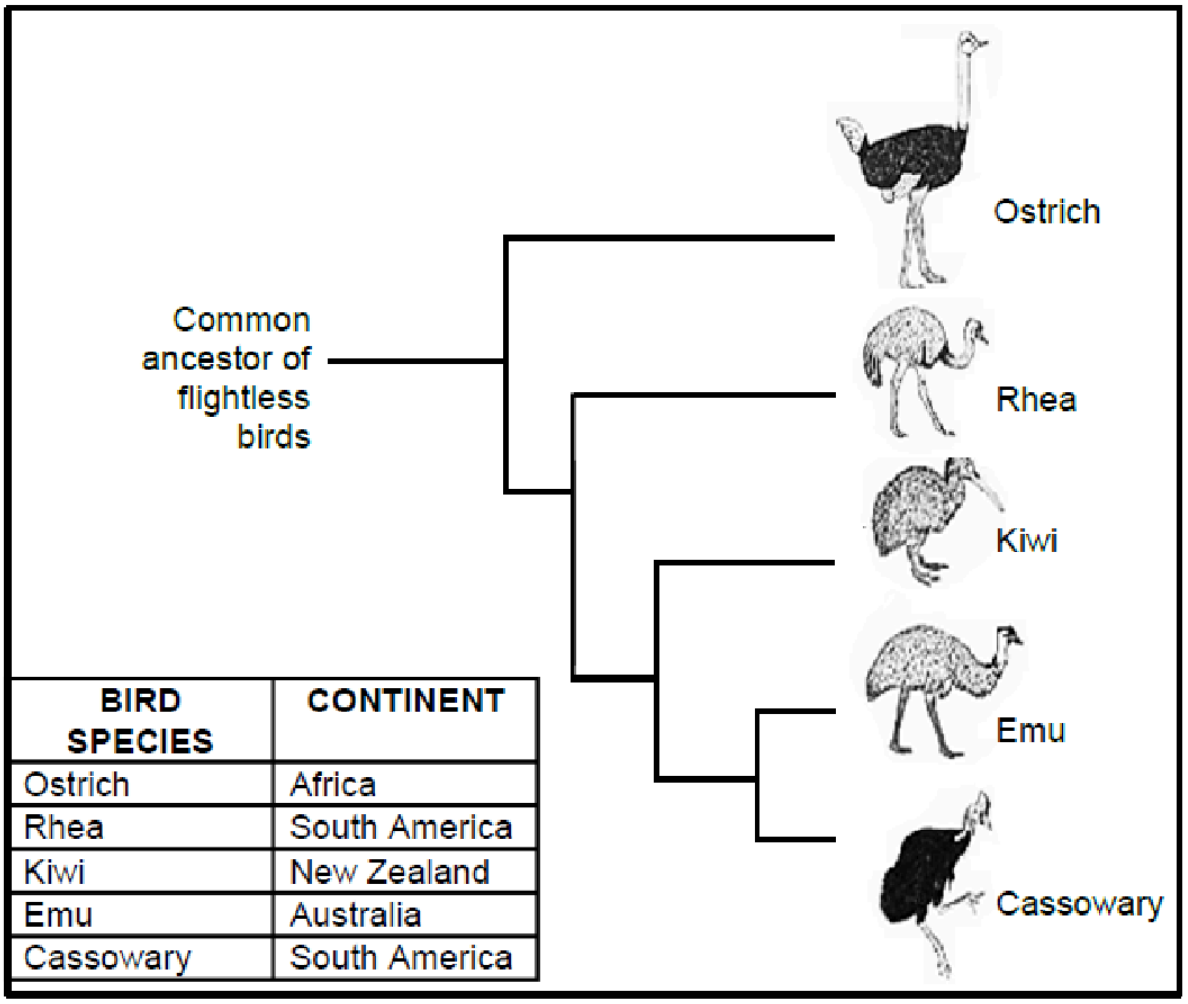
Question 22

The diagram below shows the relationship between different types of birds. A phylogenetic tree was created using data gathered from similarities in DNA between these birds.



BIRD SPECIES	CONTINENT
Ostrich	Africa
Rhea	South America
Kiwi	New Zealand
Emu	Australia
Cassowary	South America

Figure 7: Ratite biogeography. Source: https://www.mrtredinnick.com/uploads/7/2/1/5/7215292/map_lab_-_ratite_geoinquiry.pdf

a) Identify the TWO species that share the most recent common ancestor. **1m**

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QUESTION 22 CONTINUED OVER PAGE

b) Use the information from the diagram above and other relevant knowledge to discuss the evidence that supports the theory of evolution. **5m**

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Question 23

Myxomatosis is a disease which was imported into Australia in the early 1950s to control rabbits.
It was spectacularly successful, reducing rabbit numbers across the country by around 95%.
There are still small outbreaks today, but far fewer rabbits die from it, most survive.

Explain how this could have come about. **3m**

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Question 24

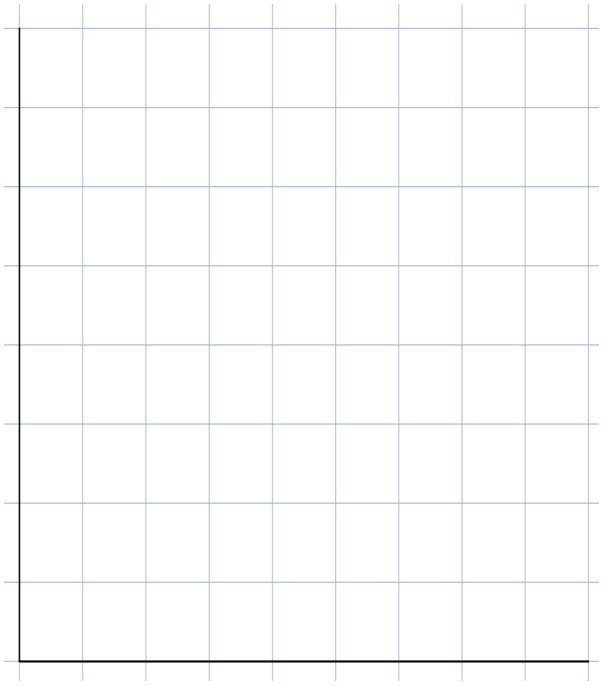
Peter and Rosemary Grant spent over 40 years collecting data on the Medium Ground Finches that populated the island of Daphne Major in the Galapagos Archipelago. They measured many features of the birds including beak depth, wing length and body mass.

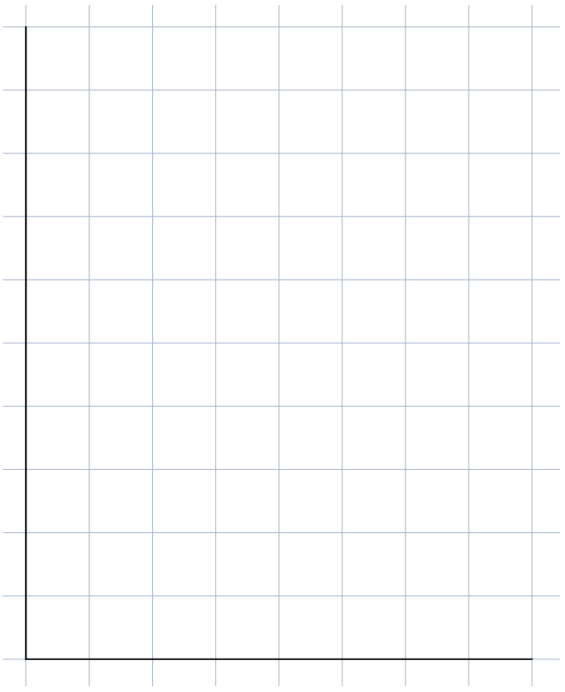
Figure 8: Medium ground finch on Daphne Major in the Galapagos https://ebird.org/species/megfin1

Data was collected about the Finch wing length and body mass during 1976. At the end of this year a drought occurred on the island. In 1977 data was again gathered on wing length and body mass. The information in the table below relates to 50 randomly chosen finches that survived the drought and 50 randomly chosen finches that did not survive the drought.

	Body Mass (g)		Wing Length (mm)	
	Non survivors	Survivors	Non survivors	Survivors
Average	15.70	17.00	67.8	69.3

a) Use the information given in the table above to construct TWO different column graphs for the data provided on the axes below. **3m**





b) Based on the data supplied propose a hypothesis that relates the physical characteristics of the birds to their likelihood of survival. **2m**

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c) The Grant's research indicated that beak depth was more important in the survival of the finches than wing length or body mass in periods of drought. Explain why beak depth was more important to finch survival than the other characteristics that were measured.

3m

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-END OF EXAMINATION-

PART A – INSTRUCTIONS FOR MULTIPLE CHOICE QUESTIONS

Use the multiple-choice answer sheet provided to answer PART A.

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

Example 2 + 4 = ?

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:

Student Number: _____

PART A – MCQ 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 ⬭