

MC /20	M1 /13	M2 /13	M3 /10	M4 /19	Total /75



Student Name: _____

Teacher: _____

Sydney Technical High School

2023

YEAR 11
Biology Examination
Task 3

Biology

General Instructions

- Answer in the spaces provided
- **Attempt all questions**
- Write using black pen
- Lead pencil to be used for diagrams and graphs
- Approved calculators to be used
- **Five minutes reading time**
- **2 hour written exam**
- Include ALL working out
- This exam 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 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
A B C D

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

A B C D

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.

A B C D
correct

PRELIMINARY EXAMINATION

Biology

Multiple Choice Answer Sheet

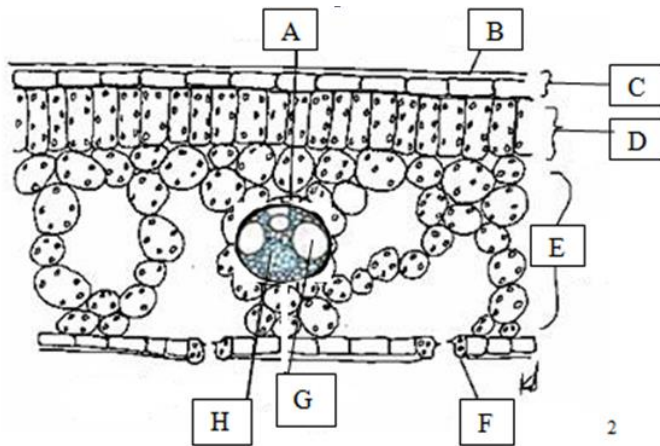
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|-----|---|-----------------------|---|-----------------------|---|-----------------------|---|-----------------------|
| 1. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 2. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 3. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
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| 5. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 6. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 7. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 8. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 9. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 10. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 11. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 12. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 13. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 14. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 15. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 16. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 17. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 18. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 19. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 20. | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |

1. Environments are made up of different levels of biological organisation.
Which statement below is correct regarding the biological levels of organisations?
 - (A) Individuals make up populations which form communities in ecosystems
 - (B) Individuals make up communities which form populations in ecosystems
 - (C) Individuals make up populations which form ecosystems in biomes
 - (D) Individuals make up ecosystems which form populations in biomes

2. What is the best description of a colonial organism?
 - (A) A small multicellular organism.
 - (B) An organism made of at least two types of cells that are specialised for particular roles.
 - (C) A collection of similar cells working together.
 - (D) A group of organisms that have different roles and work together.

3. Which of the following statements correctly describes diffusion and active transport?
 - (A) Diffusion is the movement of particles from an area of high concentration to an area of low concentration. Active transport moves along the concentration gradient and particles move from areas of high concentration to areas of low concentration.
 - (B) Diffusion is the movement of particles from an area of low concentration to an area of high concentration. Active transport moves along the concentration gradient and particles move from areas of high concentration to areas of low concentration.
 - (C) Diffusion is the movement of particles from an area of high concentration to an area of low concentration. Active transport involves the movement of particles against a concentration gradient, that is from an area of relatively low concentration to an area of high concentration.
 - (D) Diffusion is the movement against the concentration gradient, that is particles move from an area of relatively low concentration to an area of high concentration. Active transport is the movement of particles from an area of high concentration to an area of low concentration.

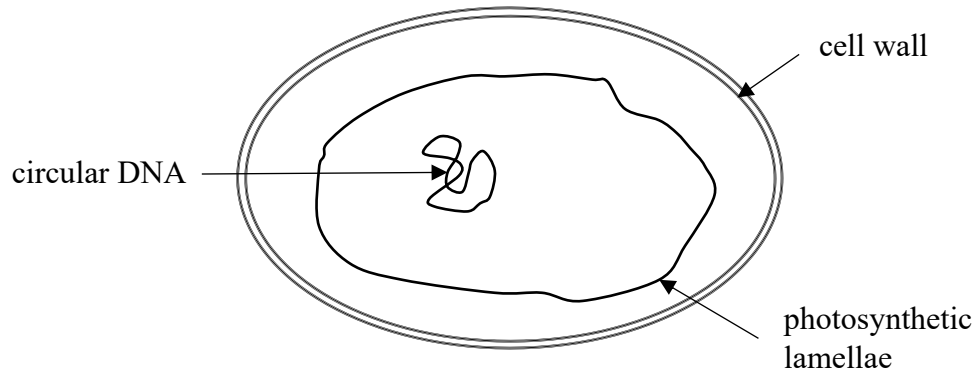
4. The diagram below shows a transverse section of a leaf.



The epidermis of the leaf is represented by which of the following letters?

- (A) E
- (B) C
- (C) D
- (D) B

5. The diagram below shows a unicellular aquatic organism.



The

This organism is most likely to be:

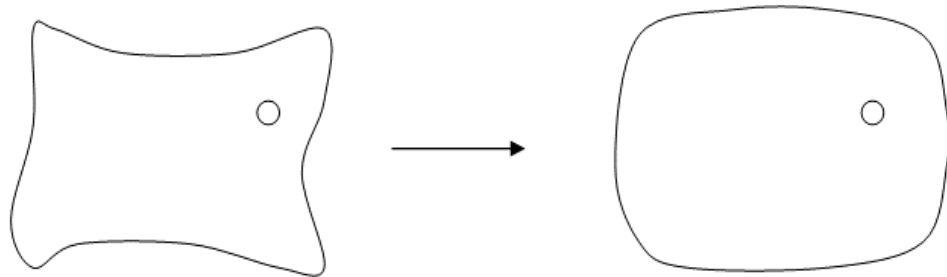
- (A) An autotrophic prokaryote
- (B) A heterotrophic prokaryote
- (C) An autotrophic eukaryote
- (D) A heterotrophic eukaryote

6. Starch is present in large quantities in most plant cells.

Its main role is:

- (A) part of the cell membrane
- (B) part of the cell wall
- (C) a source of instant energy
- (D) an energy store

7. The transferred diagram below shows what happens to a plant cell when it is transferred from one solution to another.

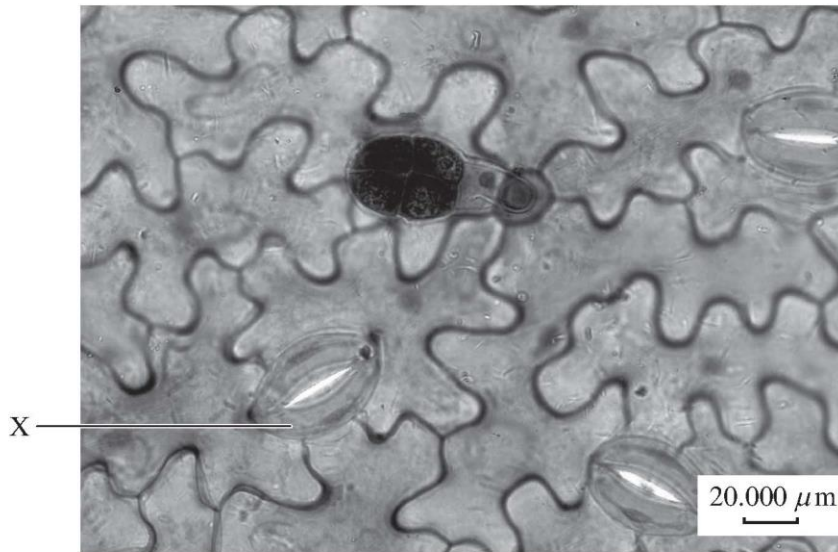


Which of the following transfers would bring about this type of change:

- (A) From 20% saline to fresh water
- (B) From freshwater to 20% saline
- (C) From 20% saline to 20% starch solution
- (D) From 20% starch solution to 20% saline

Questions 8 and 9 refer to the information provided below.

This photograph below shows the epidermis of a leaf. Cell X has been labelled.



Source: Reproduced with permission from Cheesewright, Rhiannon (2022).

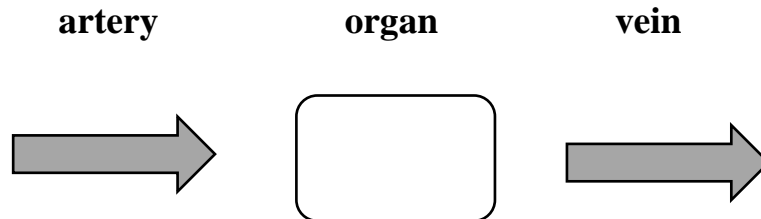
8. What is the name of Cell X?

- (A) Epidermal cell
- (B) Sieve plate
- (C) Stomate
- (D) Guard cell

9. Using the scale provided in the photograph, what is the estimated length of Cell X?

- (A) 20 μm
- (B) 60 μm
- (C) 200 μm
- (D) 600 μm

10. Samples of blood were taken from an artery leading into an organ and the vein flowing from it.



Analysis of the blood revealed the following relative levels:

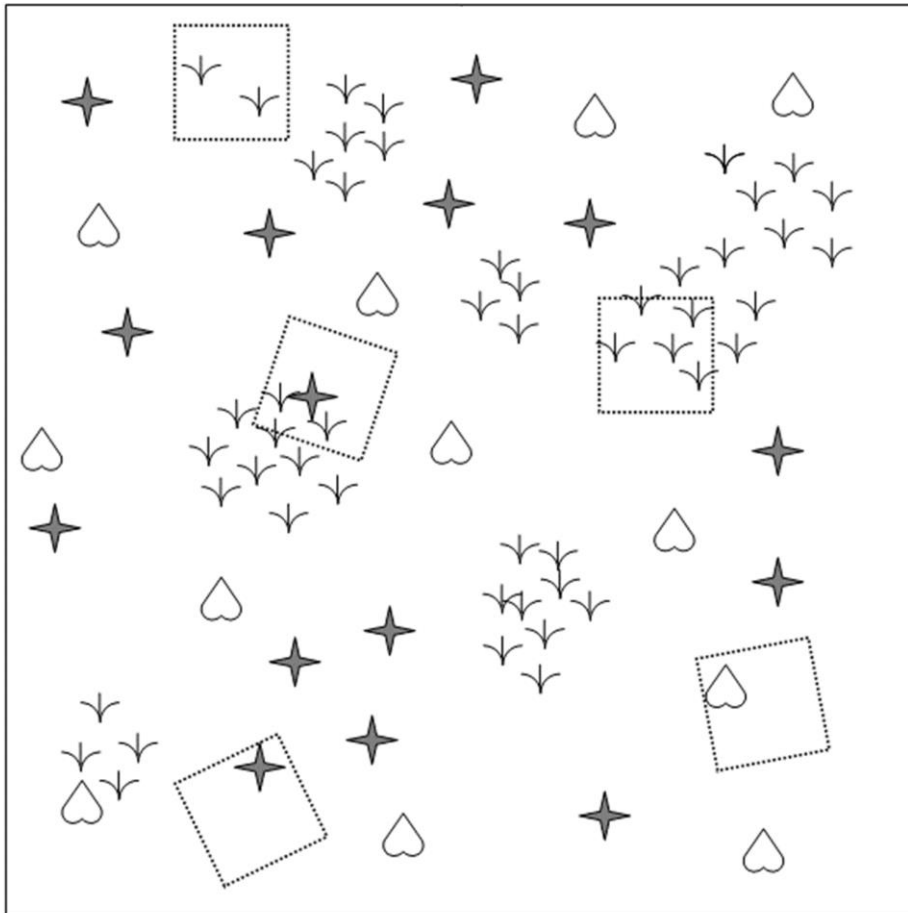
	Artery	Vein
oxygen	high	low
carbon dioxide	low	high
glucose	low	high

The organ is most likely to be the:

- (A) small intestine
- (B) lungs
- (C) heart
- (D) kidney

Questions 11 and 12 refer to the diagram below, which shows the distribution of three plant species on an area of sand dune.

- ★ bitou bush
- ∨ spinifex
- ♡ mat plant



The large square represents an area 6m x 6m, and the five smaller squares are 1m² quadrats.

11. Using the five quadrats, determine the population density of bitou bush.

- (A) 12 plants / m².
- (B) 1 plant / m².
- (C) 0.4 plants / m².
- (D) 0.2 plants / m².

12. In a study such as this, what is the main advantage of increasing the number of quadrats used.
- (A) It reduces the effect of an uneven distribution of plants.
 - (B) It reduces the effect of experimental bias.
 - (C) It makes the counting of plants more precise.
 - (D) It allows for the population density of more than one species to be measured.

13. Which one of the following lists contains just abiotic factors?

- (A) temperature, soil depth, aspect, tree cover.
- (B) soil moisture, salinity, gradient, aspect.
- (C) predator, prey, competitor, pathogen.
- (D) prey, competitor, soil depth, gradient.

14. Plants in tropical rainforests have large, thick waxy leaves with pointed tips that funnel water off to prevent fungal growth.

This is an example of which type of adaptation?

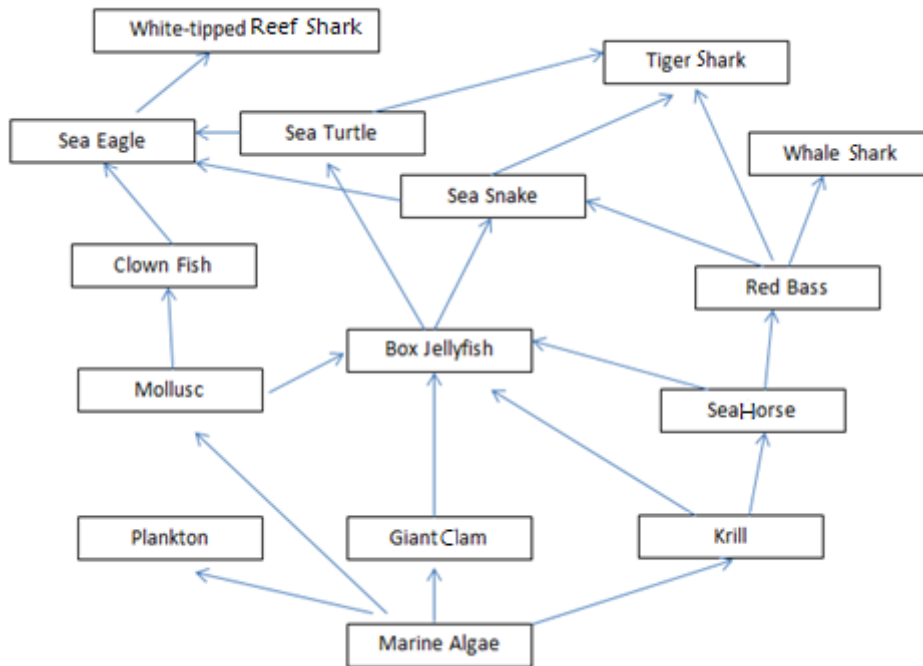
- (A) Behavioural
- (B) Physiological
- (C) Structural
- (D) Psychological

15. In a national park, wildlife officers wish to estimate the possum population. They tag and release 75 possums. Three days later they make another capture of 220 possums. Of this group 15 are tagged. The officers use this information to estimate the population size.

What is the estimated size of the possum population?

- (A) 44
- (B) 220
- (C) 1100
- (D) 1125

Questions 16 and 17 refer to the food web below.



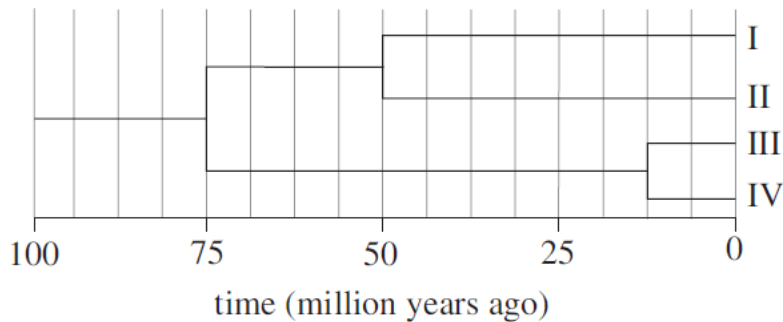
16. Which of the following is the primary producer in the food web?
- (A) Tiger shark
 - (B) Sea turtle
 - (C) Krill
 - (D) Marine algae
17. There are many food chains in the food web above. Which correctly shows a food chain for this food web?
- (A) Marine algae → box jellyfish → sea snake
 - (B) Marine algae → giant clam → box jellyfish → sea turtle
 - (C) White-tipped reef shark → sea eagle → clown fish → molluscs
 - (D) Plankton → marine algae → krill

18. Sharks and dolphins occupy similar marine environments. Sharks are cartilaginous fish, while dolphins are mammals.

Sharks and dolphins are an example of convergent evolution because they

- (A) have similar environmental pressures that select similar traits such as streamlining and a grey colour.
- (B) occupy different niches within similar environments, so they have developed different feeding strategies.
- (C) share a common ancestor, so they show very similar traits.
- (D) share the same DNA, so they show very similar traits.

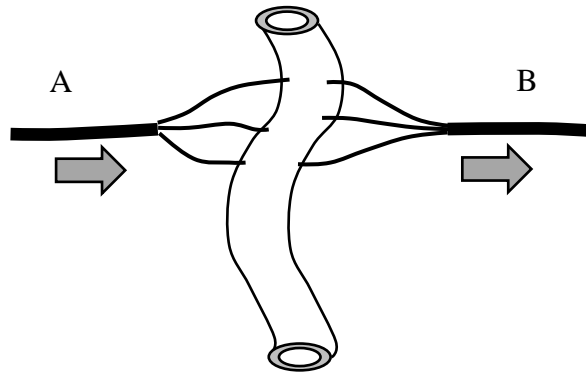
19. The diagram shows an evolutionary cladogram for organisms I, II, III and IV.



What conclusion can be drawn about the evolution of the organisms from the graph?

- (A) Organism I is the ancestor of all the organisms shown in the graph.
- (B) Organisms II and III are more similar to each other than organisms III and IV.
- (C) Organisms III and IV are most likely a chimpanzee and a human.
- (D) Organisms I, II, III and IV shared a common ancestor.

20. The diagram below represents the flow of blood to and from the small intestine in the human body.



Choose the correct option below which best compares Blood vessels A and B.

	A	B
(A)	<ul style="list-style-type: none"> • thick-walled • high pressure blood • valves 	<ul style="list-style-type: none"> • thin walled • low pressure blood • no valves
(B)	<ul style="list-style-type: none"> • thin walled • low pressure blood • no valves 	<ul style="list-style-type: none"> • thick-walled • high pressure blood • valves
(C)	<ul style="list-style-type: none"> • thick-walled • low pressure blood • valves 	<ul style="list-style-type: none"> • thin walled • high pressure blood • no valves
(D)	<ul style="list-style-type: none"> • thick-walled • high pressure blood • no valves 	<ul style="list-style-type: none"> • thin walled • low pressure blood • valves

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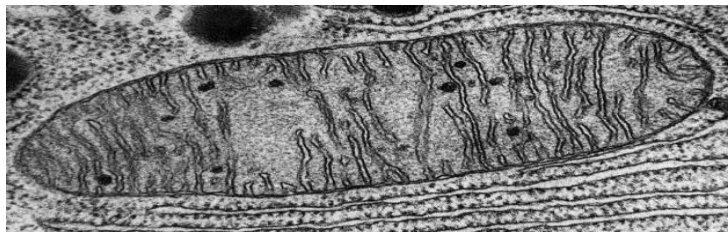
Part B – 55 marks
Attempt Questions 21 –31

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 /13
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Question 21(7 marks)

The photograph below shows an organelle from a eukaryotic cell:



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 1 μm

(a) Identify the organelle.

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(b) Determine the length of the organelle.

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(c) Describe one way in which the structure of this organelle is suited to its function. 3

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Question 21 continues on the next page

Question 21(continued)

(d) Name a type of cell that you would expect to have large number of this organelle?

Justify your answer.

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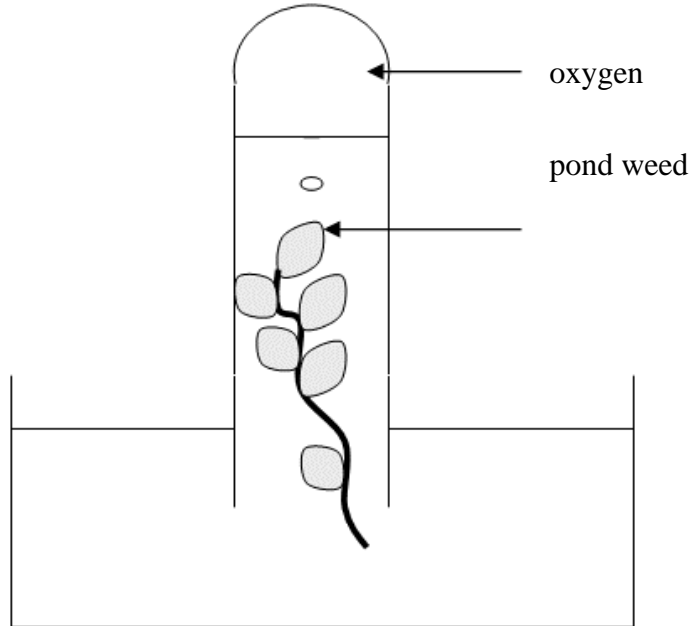
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Question 22(6 marks)

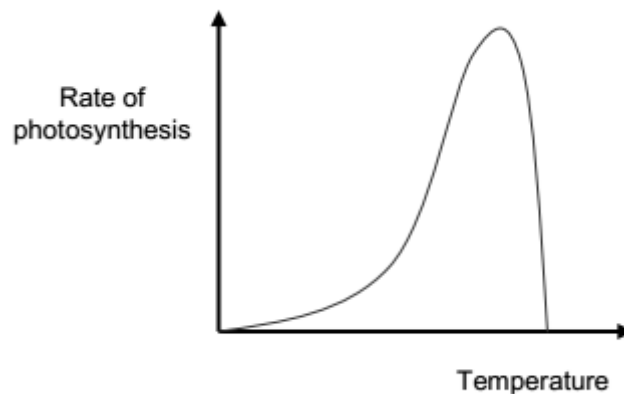
A biologist set up the apparatus below:



The biologist measured the rate of photosynthesis by measuring the rate of oxygen produced over ten minutes.

The temperature of the pond water was then changed, and the experiment was repeated. The biologist did this over a range of temperatures.

The following graph summarise the results of this experiment.



Question 22 continues on the next page

Question 22 (continued)

(a) Suggest a hypothesis the biologist might have been investigating. **1**

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(b) Identify TWO variables that would need to be kept constant throughout this experiment.

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(c) Explain the results that are shown in the graph. **3**

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Module 2	Marks /13
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Question 23 (6 marks)

Consider the information about digestive enzymes:

Amylase begins the chemical digestion process in the mouth, breaks down starch and works best in weak acidic conditions. Its optimum pH is 6.7–7. Amylase cannot work in the stomach, where the pH is 1.5–3. Similarly, it loses its ability to catalyse reactions in basic conditions such as in the duodenum, which has a pH level of 8–9. Catalase has an optimum pH of 9 and a working pH range of 7–11. Rennin is a digestive enzyme found in gastric juices in the stomach. It loses the ability to function in neutral and basic conditions.

(a) Using the information provided, sketch **THREE** graphs on the grid below to show the effect of pH on the activity of amylase, catalase and rennin.

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Question 23 continues on the next page

Question 23 (continued)

(b) The optimum pH range for the enzyme trypsin is 7.5–8.5.

Describe where in the digestive tract trypsin would most likely act to digest proteins. 2

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Question 24 (4 marks)

Explain using two examples, how gas exchange structures facilitate their function.

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Question 25 (3 marks)

Outline a method of an experiment that students would undertake to investigate the movement of materials in the xylem of a plant.

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Question 26 (4 marks)

Module 3	Marks /10
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In 1986, the explosion of one of the reactors at the nuclear power plant in Chernobyl, Ukraine, caused a nuclear disaster. The resulting leak of radioactive material spread ionising radiation into parts of Russia and Europe.

Scientists have observed the rapid evolution of the Eastern San Antonio frog population since the nuclear disaster. The diagram shows the variation in the colours of the Eastern San Antonio frog (*Hyla orientalis*) population in Chernobyl.



Colour gradient of the Eastern San Antonio frog

Prior to 1986, light-coloured frogs were the most abundant variant in the population. In 2016, scientists detected dark-coloured frogs in the Chernobyl area. The dark-coloured frogs are now the dominant variant in Chernobyl, while the light-coloured frogs remain the dominant variant in other parts of Ukraine.

Melanin is the pigment that makes the skin of many animals dark. It can reduce the negative effects of UV radiation and protect against cellular damage. Scientists believe melanin can also help protect against the effects of ionising radiation.

Using your knowledge of Darwin and Wallace’s Theory of Evolution by Natural Selection, explain the evolution of the Eastern San Antonio frog population in Chernobyl since the nuclear disaster.

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Question 27 (3 marks)

Compare Punctuated Equilibrium to the more gradual process of Natural Selection.

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Question 28 (3 marks)

In 1996 the rabbit calicivirus was first introduced to the wild rabbit populations in Australia. Rabbit populations in Australia declined dramatically as a result. In many areas of Australia, rabbit populations are starting to develop an immunity to the virus. Explain how such an immunity can result over time.

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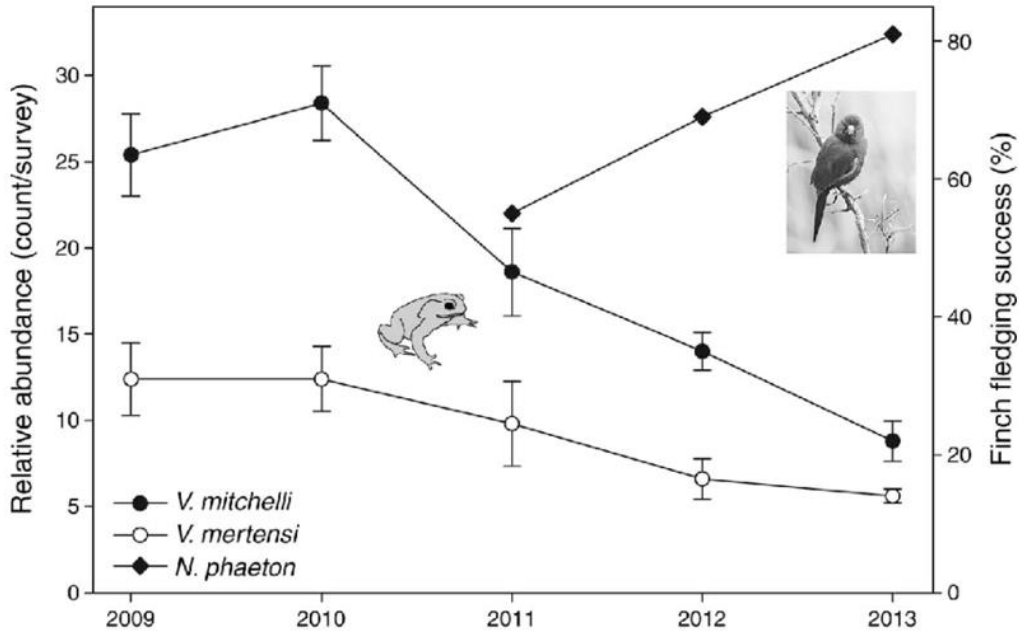
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Question 29 (7 marks)

Module 4	Marks /19
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The graph below shows the impact on the population size of two species of monitor lizards (*V. mitchelli* and *V. mertensi*) and a species of finch (*N. phaeton*) after the introduction of cane toads into their habitat.



(a) Use the graph to **construct a data table** with the survey results for the two monitor lizard species, in the space below. **3**

Question 29 continues on the next page

Question 29 (continued)

(b) Based on all the data illustrated in the graph, explain the impact of cane toads on the monitor lizard and finch populations. Include a possible reason for the trends seen. **4**

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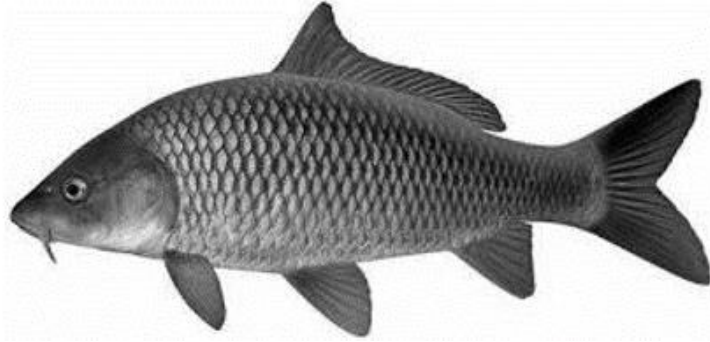
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Question 30 (7 marks)

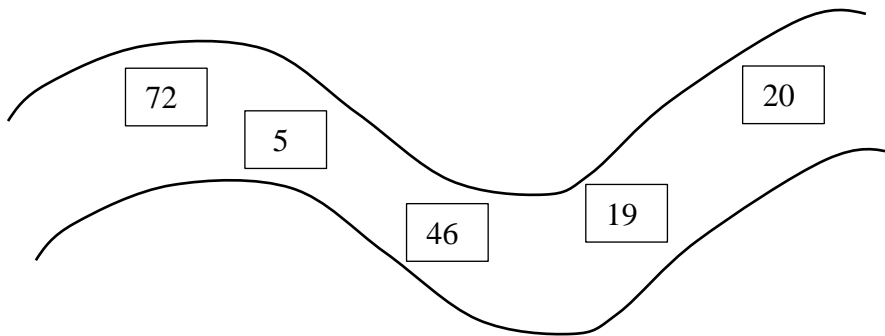
The European carp is an introduced species which has become a major pest in many of the inland waterways of Australia.



A group of researchers decided to try to determine the number of carp present in a section of the river.

They used the Capture/Tag/Recapture method.

They set 5 traps along the river section. The number of carp caught in the traps are shown below.



(a) Determine the total number of carp caught on Day 1. **1**

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Question 30 continues on the next page

Question 30(b) (continued)

These carp were all tagged and then released back into the river.

On Day 2 the same traps were set again and a total of 110 carp were captured. Of these 45 had tags.

The researchers then used the formula below to calculate the total carp population of that section of river.

$$N = \frac{MT}{R}$$

- Where **N** = the total population of Carp.
- M** = the total number captured on Day 1.
- T** = the total number captured on Day 2.
- R** = the total number of tagged individuals recaptured.

Use the formula above and the numbers provided to calculate the population of carp for that section of the river. **3**

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Question 30 continues on the next page

Question 30(c) (continued)

This method relies on a number of assumptions. One assumption is that every carp is as likely to be trapped as every other carp.

Describe how the results would be affected if some carp were more willing to swim into the trap, while other carp are more “trap-shy”? Justify your answer. **3**

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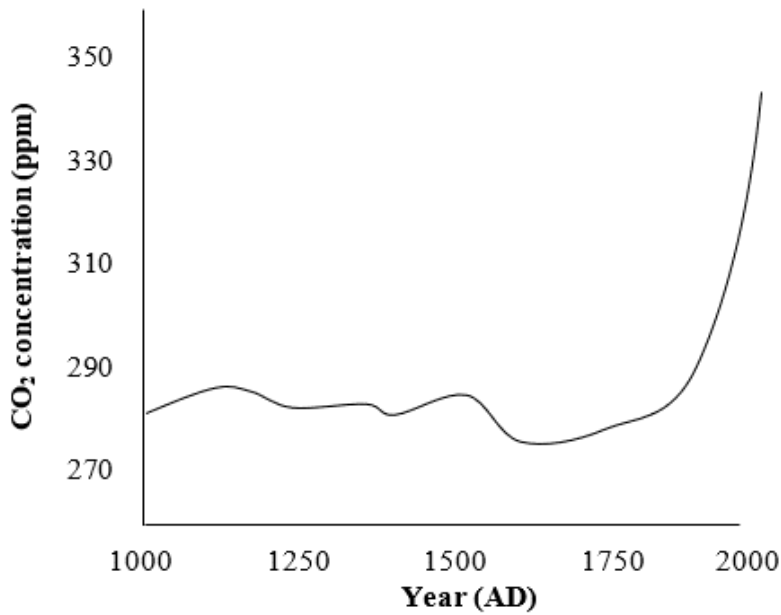
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Question 31 (5 marks)

Law Dome is an ice cap on the coast of Antarctica that is situated due south from Australia. For the last 40 years scientists have been extracting and analysing ice core samples.

By tracking the CO₂ content of air bubbles trapped within the ice scientists, are able to track historic changes in atmospheric CO₂ levels.



(a) Account for the pattern revealed in the graph above.

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Question 31 continues on the next page

Question 31 (continued)

(b) Explain how increased CO₂ concentrations in the atmosphere can result in changes in a specific ecosystem. **3**

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END OF THE EXAM

