



# Pymble Ladies' College

## Year 11 Biology

### Preliminary Examination

2023

Time allowed 2 hours + 5 mins Reading Time

#### General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black pen
- Draw diagrams using pencil
- Board-approved calculators may be used

#### Total marks – 90

This paper has two parts, Part A and Part B

Part A – 15 marks

- Attempt Questions 1–15
- Allow about 25 minutes for this part

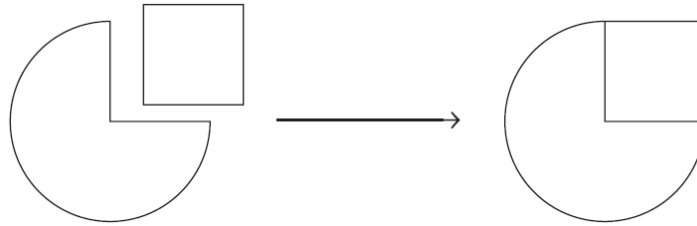
Part B – 75 marks

- Attempt Questions 16–27
- Allow about 1 hours and 35 minutes for this part

- Multiple choice questions are to be *answered* on page 23. This may be removed from the paper.
- If you need extra space, **indicate clearly** on the relevant question and complete your answer in the extra writing space on page 20-21.
- The lined spaces in the question booklet are a guide to the expected length of your answer.
- Please write your student number and circle your teacher's initials on the front page and on the multiple choice answer sheet.



1. The following diagram shows an enzyme and a substrate binding together.



What term best describes the model shown in the diagram above?

- A. Induced fit
- B. Lock and key
- C. Substrate complex
- D. Catabolic reaction

2. The electron micrograph (or photomicrograph) below is of a cell organelle.



Which one of the following identifies the organelle and best describes its function?

	<b>Organelle</b>	<b>How is the structure related to its function</b>
A.	Endoplasmic reticulum	A network of flattened, interconnected membranes that provide a pathway between the nucleus and the cell's environment, allowing intracellular transport of molecules
B.	Endoplasmic reticulum	Series of flat membranes that process, package and sort cell products
C.	Mitochondria	Layering of the membranes increases the surface area allowing a large amount of sunlight to be absorbed for the process of photosynthesis
D.	Mitochondria	Consists of a double membrane which the inner membrane is folded into fine, finger-like ridges increasing surface area for producing energy for the cell

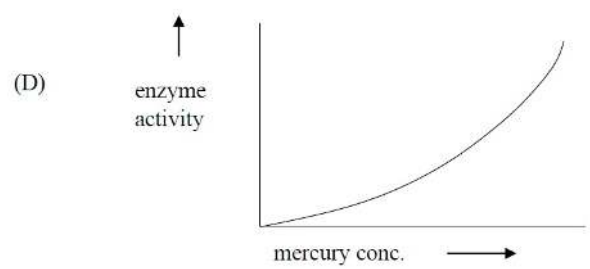
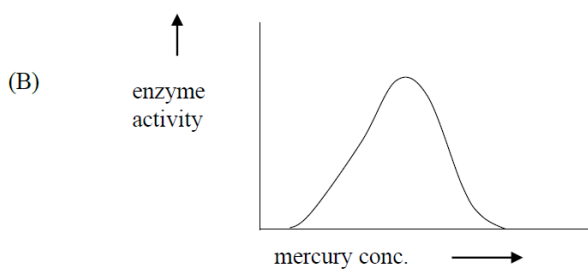
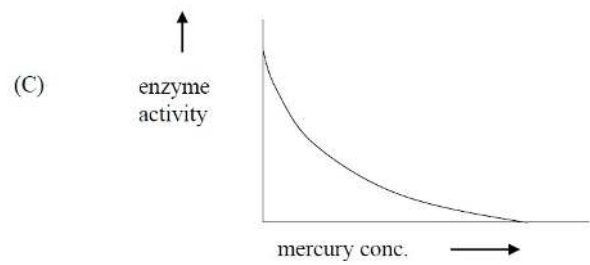
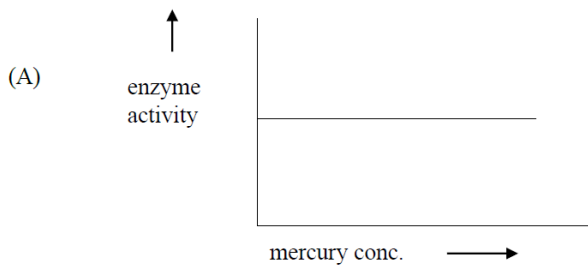
3. I am a major component in the fluid mosaic model of the cell membrane. I am composed of carbon, hydrogen and oxygen atoms. I am a source of stored energy.

Which organic molecule am I?

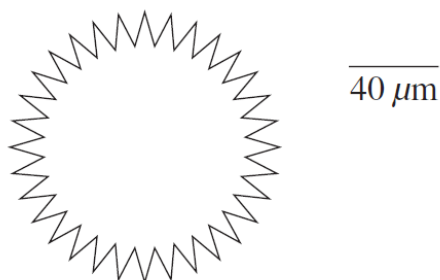
- A. Lipids
- B. Proteins
- C. Nucleic acids
- D. Carbohydrates

4. Poisons like mercury interfere with enzyme function by partially blocking the active site.

Which graph below best represents the relationship between mercury concentration and enzyme activity?



The following diagram represents a cell.

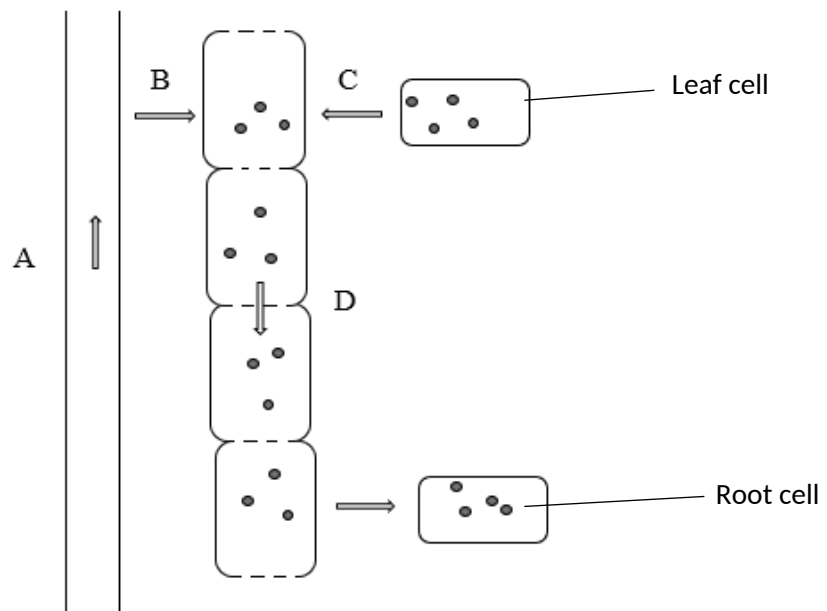


Which one of the following is closest to the diameter of the cell (including spikes) shown above?

- A. 1200mm
- B. 120mm
- C. 1200 $\mu$ m
- D. 120 $\mu$ m

6. Which of the following best summarises the changes to blood composition as it passes through the muscles?
- A. Increase in oxygen and decrease in glucose and carbon dioxide.
  - B. Decrease in oxygen and increase in glucose and carbon dioxide.
  - C. Increase in carbon dioxide and decrease in oxygen and glucose.
  - D. Decrease in carbon dioxide and increase in oxygen and glucose.
7. Which one of the following combinations is necessary for gas exchange in human lungs?
- A. Alveoli and diffusion
  - B. Bronchi and diffusion
  - C. Capillaries and osmosis
  - D. Alveoli and active transport
8. Which response best describes why arteries in the human circulatory system have thick, strong walls?
- A. Arteries are attached directly to the heart.
  - B. Arteries convey high volumes of blood back to the heart at low pressure.
  - C. Arteries contain one-way valves to prevent blood flowing in the wrong direction.
  - D. Arteries accommodate the rapid flow and high pressure of blood pumped by the heart.
9. Which of the following examples demonstrates the impact of biotic factors in an ecosystem?
- A. Changes in temperature affecting plant growth.
  - B. Variation in soil pH affecting the distribution of trees.
  - C. Competition between two species of birds for nesting sites.
  - D. Changes in atmospheric pressure affecting insect populations.
10. 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. Structural
  - B. Behavioural
  - C. Physiological
  - D. Psychological

Questions 11 and 12 refer to the diagram below, which represents the movement of materials through plant vascular tissue.



11. Which arrow represents a process which uses active transport?

- A. A
- B. B
- C. C
- D. D

12. Name the substance whose movement is represented by the arrow at B.

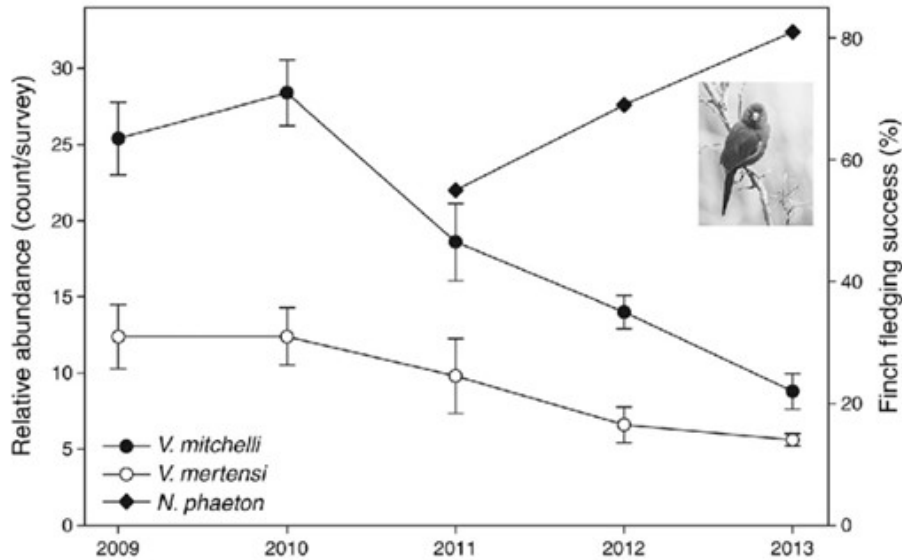
- A. Water
- B. Starch
- C. Sucrose
- D. Chlorophyll

13. What is the term used to describe a close relationship between two different species where one benefits, and the other is neither benefited nor harmed?

- A. Predation
- B. Parasitism
- C. Competition
- D. Commensalism

**Question 14 refers to the graph below**

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 in 2010. Monitor lizards feed on the eggs of finches.



14. Based on the data, which statement is most accurate when describing the impact of cane toads on the monitor lizard and the finch population?

- A. The monitor *V. mitchelli* has the greatest decline in relative abundance, while the finch fledging success increased at an accelerated rate.
- B. The monitor *V. mitchelli* has the greatest decline in relative abundance, while the finch fledgling success increased at a steady rate.
- C. The monitor *V. mertensi* has the greatest decline in relative abundance, while the finch fledging success increased at a steady rate.
- D. The monitor *V. mertensi* has the greatest decline in relative abundance, while the finch fledgling success increased at an accelerated rate.

15. What evidence supports the theory of evolution by natural selection based on biochemical comparisons?

- A. Fossil evidence of transitional forms.
- B. Similarities in the physical structures of organisms.
- C. Patterns of embryonic development in different species.
- D. Common genetic code and shared reaction pathways.

**Part B**

**Total marks 75**

**Answer Questions 16 – 27 in the space provided**

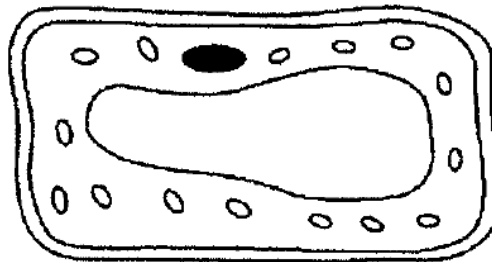
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**Question 16 (7 marks)**

A group of students collected a small sample of a pond plant. A slide of a small leaf was prepared and viewed using a light microscope. The students drew a diagram of a single cell shown below.

- a) Label 4 organelles or structures on the diagram.

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- b) Explain how you know this is an autotrophic, eukaryotic cell.

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- c) These students used a light microscope. Identify an organelle that you would expect to see in this cell using an electron microscope and outline one advantage and one disadvantage of viewing cells under under an electron microscope.

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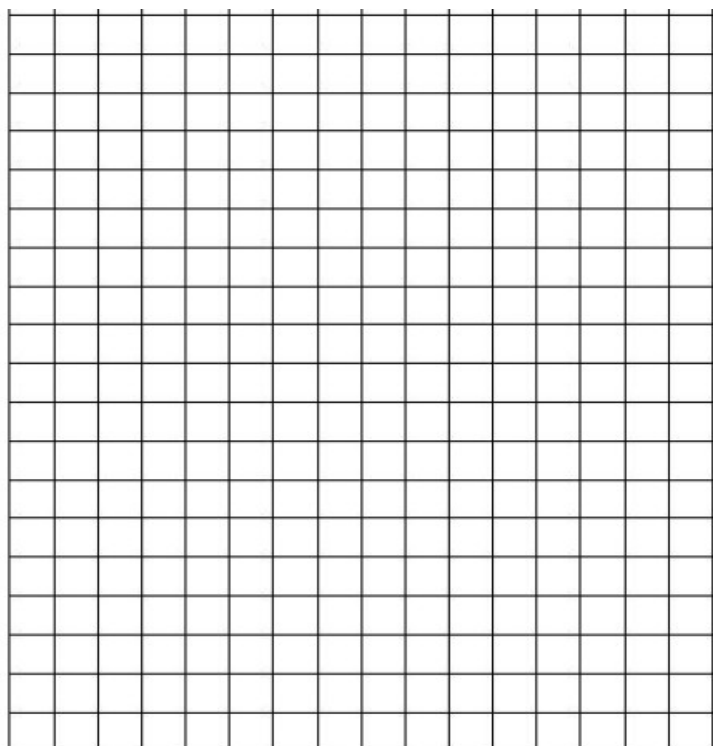
**Question 17 (7 marks)**

Five different sized cubes of agar jelly, containing pink indicator, were immersed in the same volume of acid. As acid penetrated the agar it caused the indicator to change from pink to clear. The table below shows how long each cube took to become completely clear.

Length of one side of cube (cm)	1	2	3	5	7
Time taken to turn clear (minutes)	2	6	18	54	160

a) Graph the data on the grid below.

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b) Predict the time taken for a 6cm cube to turn clear from your graph.

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c) Explain which cube has the lowest SA/V ratio using evidence from these results.

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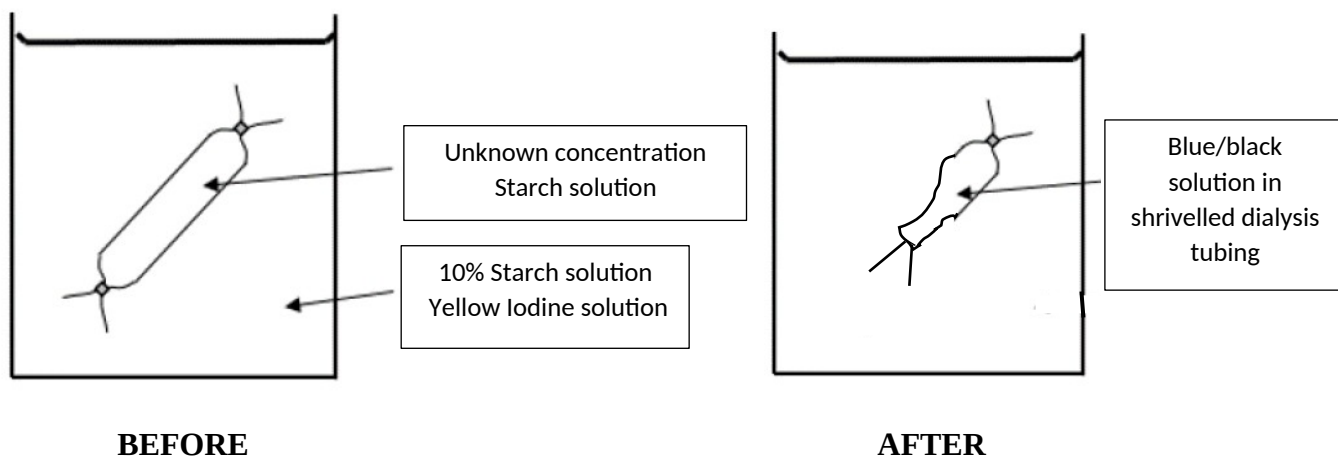
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**Question 18 (5 marks)**

A dialysis tubing was filled with a solution of starch of unknown concentration.

The mass of the tubing was measured at 425g.

The dialysis tubing was placed in a beaker of 10% starch solution and yellow iodine solution.



The dialysis tubing was removed from the beaker after 60 minutes and the mass of the tubing was 325g.

It was observed that the starch solution in the dialysis tubing had turned blue/black.

- a) Estimate the concentration of the starch solution inside the dialysis tubing at the start of the experiment. 1

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- b) Explain the change in colour and mass of the dialysis tubing in terms of diffusion and osmosis. 4

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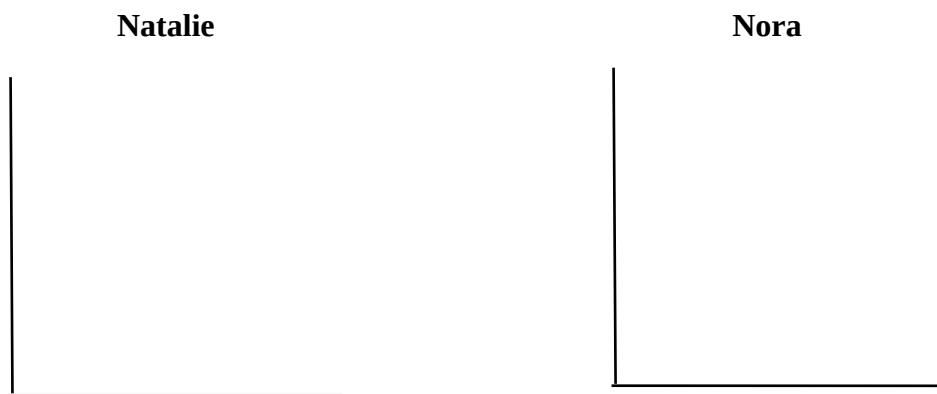
**Question 19 (6 marks)**

Natalie and Nora were conducting an experiment to investigate the effect of raising the temperature from 20°C to 60°C on enzyme activity in bacteria.

Natalie believed that enzyme activity would increase as the temperature was raised until the optimum temperature of 40°C, where the enzyme activity would remain the same.

Nora believed that enzyme activity would increase as the temperature was raised until the optimum temperature of 40°C, where the enzyme activity would decrease rapidly.

- a) Draw graphs to demonstrate Natalie and Nora’s prediction of the effect of temperature on enzyme activity. 2



- b) Who is correct? Justify your response using your knowledge of enzymes. 4

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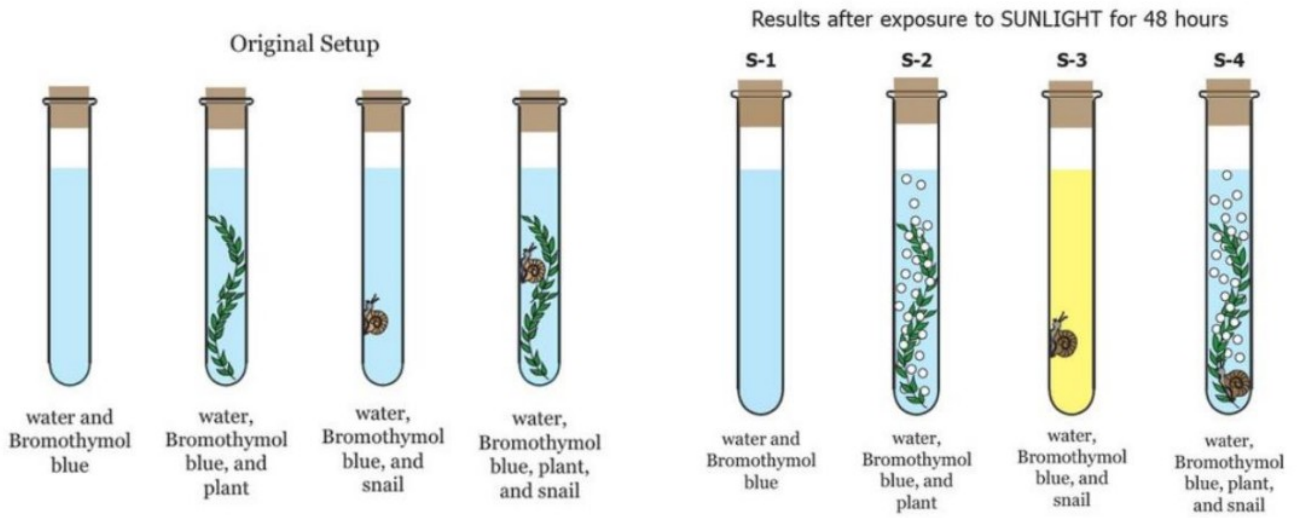
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**Question 20 (7 marks)**

The diagrams below show the outcome of a student experiment using water snails to investigate photosynthesis and respiration. The experiment had been running for a week. Bromothymol blue (BTB) is an indicator which turns yellow in the presence of carbon dioxide.



a) How did the student ensure this experiment was valid? 3

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At the end of the week, the plant in S-2 and the snail in S-3 were dead. She turned to ChatGPT for an explanation. Below is the response ChatGPT produced.

*The snail died as there was no more oxygen left in S-3. The plant died as there was no more carbon dioxide left for photosynthesis in S-2.*

b) Assess this response. 4

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**Question 22 (5 marks)**

Draw a table to compare open and closed circulatory systems with examples.

**Question 23 (3 marks)**

Identify and explain how one feature of the small intestine ensures efficient digestion and absorption.

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**Question 24 (4 marks)**

The image below shows a fossil of Archaeopteryx, an example of a transitional form that possesses features from two animal groups: bird and reptile.



Explain how this fossil is associated with the evidence for both punctuated equilibrium and gradualism.

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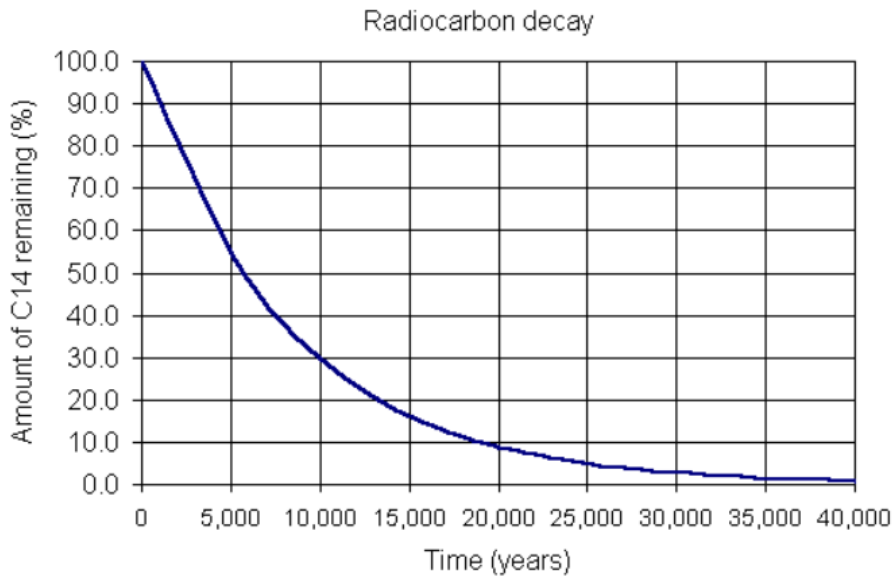
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**Question 25 (7 marks)**

A fossil was found and dated using radioactive dating. It was found to have 40% Carbon-14 remaining.



a) Using the graph, determine the age of the fossil. **1**

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b) Explain how fossils support the theory of evolution by natural selection. **3**

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c) Outline one other piece of evidence and how it supports the theory of evolution. **3**

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**Question 26 (7 marks)**

a) Describe an observation that Charles Darwin made on his travels to Australia.

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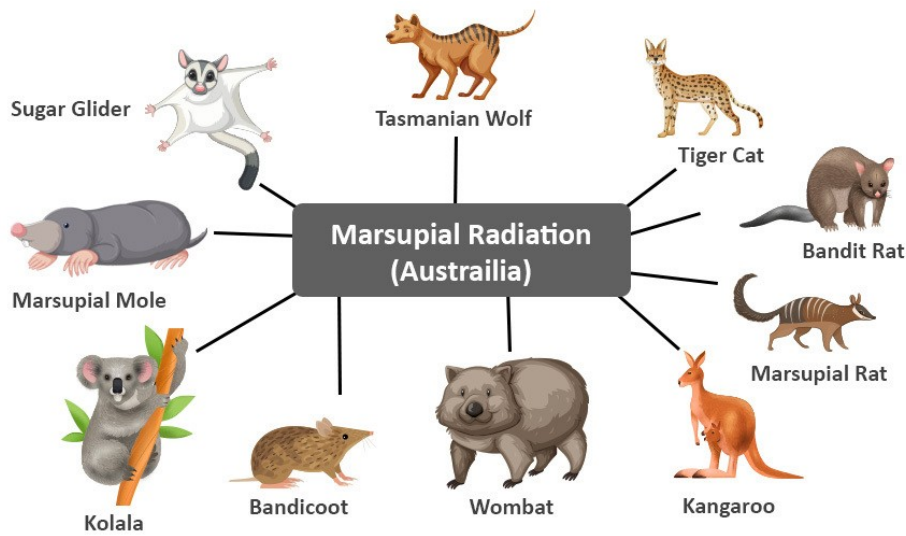
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The range of marsupial mammals in Australia evolved from a common marsupial ancestor.



b) What pattern of evolution does this represent?

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c) How would Darwin explain the differences in modern marsupials?

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**Question 27 (11 marks)**

There is an incredible amount of biological diversity on Earth. Fossil evidence shows that this diversity has resulted from evolutionary progression over about 3.5 billion years.

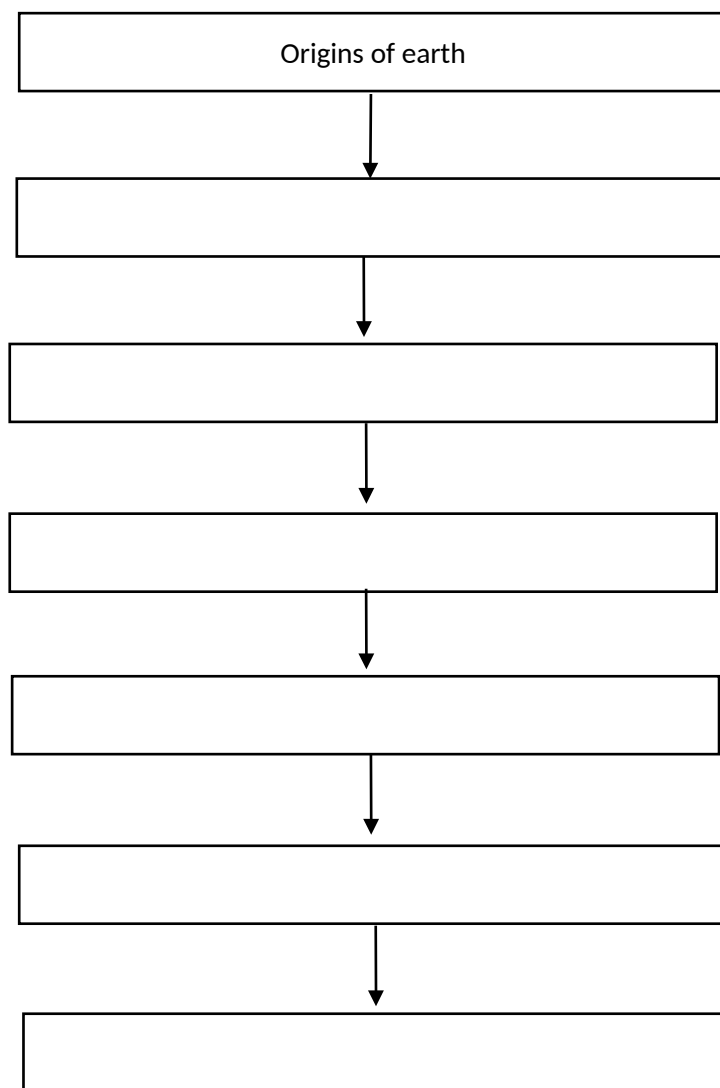
Consider the following terms which represent major stages in the evolution of life on Earth:

*multicellular organisms, prokaryotic heterotrophic cells, eukaryotic cells*

*organic molecules, prokaryotic autotrophic cells, membranes*

a) Complete the flow chart below by writing the stages shown above in the correct order.

**3**



**Question 27 continues on the next page**

b) Explain the significance of the evolution of prokaryotic autotrophic cells on the biodiversity of Earth. 4

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c) Evolution has favoured complex multicellular organisms. Discuss the advantages and disadvantages of being a multicellular organism compared to a unicellular organism. 4

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**End of examination**





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Student Number: \_\_\_\_\_

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# *Pymble Ladies' College*

## **ANSWER SHEET: PART A**

### **2023 BIOLOGY PRELIMINARY EXAMINATION MULTIPLE CHOICE**

**Start Here**

- |     |   |                       |   |                       |   |                       |   |                       |
|-----|---|-----------------------|---|-----------------------|---|-----------------------|---|-----------------------|
| 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"/> |
| 4.  | A | <input type="radio"/> | B | <input type="radio"/> | C | <input type="radio"/> | D | <input type="radio"/> |
| 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"/> |