

PRACTICE PAPER COMBINED SCIENCE — BIOLOGY

(1 hour 40 minutes)

This paper must be answered in English

GENERAL INSTRUCTIONS

1. There are **TWO** sections, A and B, in this Paper. You are advised to finish Section A in about 25 minutes.
2. Section A consists of multiple-choice questions in this question paper. Section B contains conventional questions printed separately in Question-Answer Book **B**.
3. Answers to Section A should be marked on the Multiple-choice Answer Sheet while answers to Section B should be written in the spaces provided in Question-Answer Book **B**. **The Answer Sheet for Section A and the Question-Answer Book for Section B will be collected separately at the end of the examination.**
4. The question paper for Section A will be collected at the end of the examination.

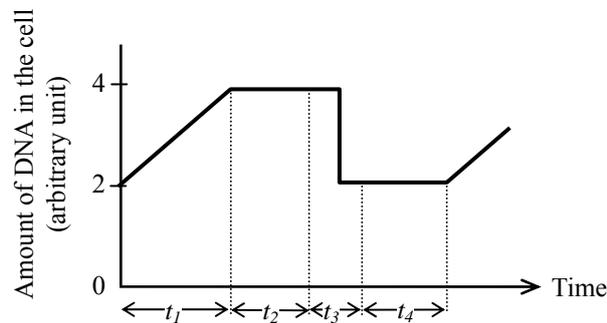
INSTRUCTIONS FOR SECTION A (MULTIPLE-CHOICE QUESTIONS)

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking on the barcode label after the 'Time is up' announcement.
2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF SECTION A**' after the last question.
3. All questions carry equal marks.
4. **ANSWER ALL QUESTIONS.** You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.
5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.
6. No marks will be deducted for wrong answers.

There are 24 questions in this section.

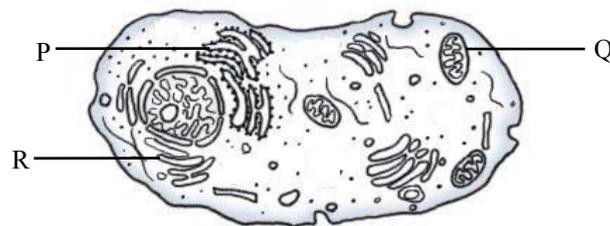
The diagrams in this section are NOT necessarily drawn to scale.

1. The graph below shows the change in the amount of DNA in a cell which is undergoing cell division:



Which of the following statements correctly describes the event that is taking place in the respective time period?

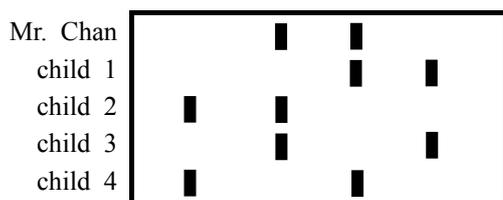
- A. During t_1 , the nuclear membrane disappears.
 - B. During t_2 , the homologous chromosomes pair up.
 - C. During t_3 , the homologous chromosomes separate.
 - D. During t_4 , the synthesis of cell organelles takes place.
2. The following diagram shows an animal cell with some of its organelles:



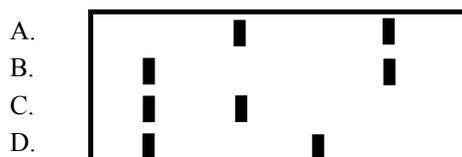
Which of the labelled structures are particularly abundant in an enzyme-secreting cell?

- A. P and Q only
 - B. P and R only
 - C. Q and R only
 - D. P, Q and R
3. Which of the following is the **least likely** effect of carrying out regular physical exercise?
- A. An improvement in muscular coordination
 - B. An improvement in cardiorespiratory functions
 - C. A reduction in the effects of stress
 - D. A lowering of the blood flow rate at rest

4. Mr. Chan and Mrs. Chan are the biological parents of four children. The DNA profiles of Mr. Chan and the four children are shown below:



Which of the following is likely to be the DNA profile of Mrs. Chan?



5. A couple has two children. The son is of blood group B and the daughter is of blood group A. Which of the following is **not** a possible combination of genotypes of this couple?

(Note: The alleles responsible for the production of antigen A, antigen B and not producing antigen A or B are represented by I^A , I^B and i respectively.)

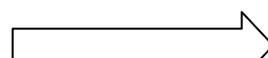
- A. $I^A i$ and $I^B i$
- B. $I^A I^A$ and $I^B i$
- C. $I^A I^B$ and $I^A I^B$
- D. $I^A I^B$ and $I^B i$

6. In guinea pigs, the genes for fur colour and hair length are located on different chromosomes. The alleles for black fur and long hair are recessive to the alleles for brown fur and short hair respectively. Guinea pigs which are heterozygous for both fur colour and hair length are allowed to breed. Of the 112 offspring produced, how many are expected to have black fur and short hair?

- A. 21
- B. 28
- C. 56
- D. 63

7. Which of the following combinations shows the correct classification of the organism according to the Three Domain System?

	<i>Organism</i>	<i>Kingdom</i>	<i>Domain</i>
A.	nitrifying bacteria	Archaeobacteria	Bacteria
B.	amoeba	Animalia	Eukarya
C.	yeast	Fungi	Archaea
D.	algae	Protista	Eukarya



8. Below are the scientific names of four species of shrimps:

- (1) *Metapenaeus joyneri*
- (2) *Metapenaeus japonicus*
- (3) *Leptochela japonicus*
- (4) *Metapenaeopsis dura*

Which two of the above species should have the closest phylogenetic relationship?

- A. (1) and (2)
- B. (1) and (4)
- C. (2) and (3)
- D. (3) and (4)

9. The following dichotomous key can be used to identify five species of amphibian:

- 1 (a) the skin is rough ----- 2
- 1 (b) the skin is smooth ----- 3
- 2 (a) the dorsal side has coloured stripes ----- Species P
- 2 (b) the dorsal side does not have coloured stripes ----- Species Q
- 3 (a) the toes have sticky pads ----- 4
- 3 (b) the toes do not have sticky pads ----- Species R
- 4 (a) the limbs are spotted ----- Species S
- 4 (b) the limbs are not spotted ----- Species T

Use the above key to identify the three amphibians in the following photographs.



Amphibian (1)



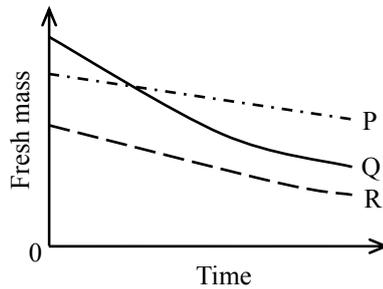
Amphibian (2)



Amphibian (3)

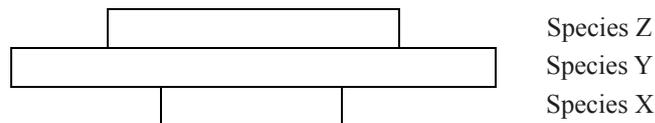
- | | <i>Amphibian (1)</i> | <i>Amphibian (2)</i> | <i>Amphibian (3)</i> |
|----|----------------------|----------------------|----------------------|
| A. | species R | species Q | species S |
| B. | species Q | species S | species R |
| C. | species T | species R | species P |
| D. | species T | species Q | species S |

10. Three types of seaweeds, P, Q and R, were collected from the intertidal zone (the zone between the high tide mark and the low tide mark) of a rocky shore. The distribution of these seaweeds in the intertidal zone is related to their ability to withstand exposure to air. The graph below shows the changes in fresh mass of these seaweeds when they are left to dry in the laboratory:



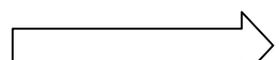
Which of the following shows the most likely distribution of these seaweeds from the lower shore to the upper shore?

- A. P, Q, R
 - B. P, R, Q
 - C. Q, R, P
 - D. R, Q, P
11. In an aquatic ecosystem, species X, Y and Z form a food chain. The following diagram shows the pyramid of biomass of this ecosystem:



With reference to the above pyramid of biomass, which of the following statements are correct?

- (1) Species Z is the secondary consumer in this food chain.
 - (2) The body size of species X is larger than that of species Y.
 - (3) There is an energy loss when energy flows from species Y to species Z.
- A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)



12. In the table below, P and Q represent two types of relationships between different species of organisms. The effect of each type of relationship on the species concerned is represented by the following symbols:

- + = gaining benefits
- = being harmed

Type of relationship between species	Effect of the relationship on the species	
	Species 1	Species 2
P	+	+
Q	-	+

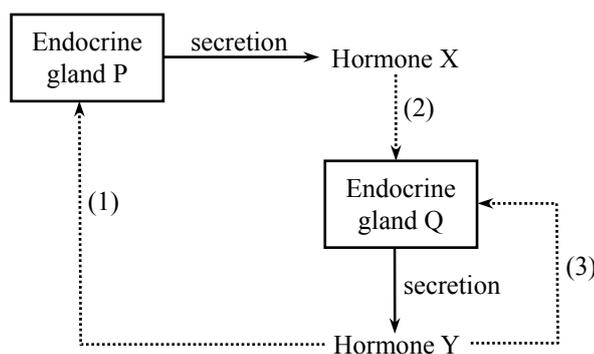
Which of the following combinations correctly shows the types of relationships represented by P and Q?

- | | <i>P</i> | <i>Q</i> |
|----|--------------|--------------|
| A. | competition | commensalism |
| B. | mutualism | competition |
| C. | commensalism | parasitism |
| D. | mutualism | predation |

13. Which of the following is **not** a limitation of the use of fossil records as evidence for evolution?

- A. Fossils are damaged and incomplete.
- B. Some organisms may not form fossils.
- C. Fossils are found in different sedimentary rock layers.
- D. Fossils present in inaccessible areas are not available to us for study.

14. The flow chart below shows the interaction between the two endocrine glands and the hormones they secrete:



Which of the following combinations correctly shows the regulation of hormone Y by a negative feedback mechanism?

- | | <i>(1)</i> | <i>(2)</i> | <i>(3)</i> |
|----|-------------|-------------|-------------|
| A. | stimulation | inhibition | stimulation |
| B. | inhibition | inhibition | stimulation |
| C. | stimulation | stimulation | inhibition |
| D. | inhibition | stimulation | inhibition |

15. Which of the following descriptions about the regulation of the blood glucose level is correct?
- The chemoreceptor in the liver detects changes in the blood glucose level.
 - The liver secretes more glucagon when the blood glucose level is low.
 - More glycogen is converted to glucose when more glucagon is secreted.
 - More glucose is taken up by cells when more glucagon is secreted.

16. The photographs below show the appearances of a flower at different times of a day:



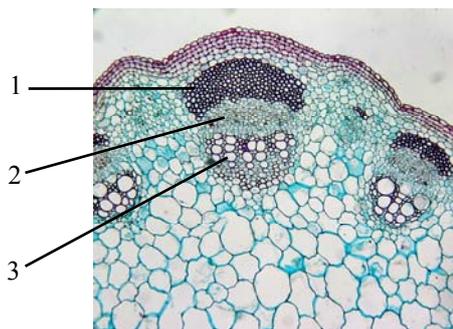
8:00 am



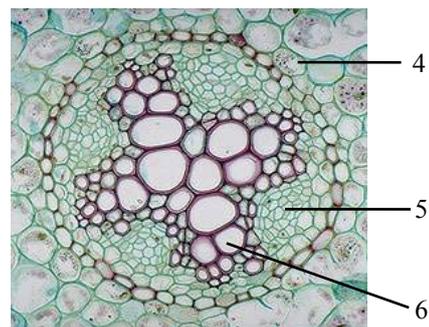
2:00 pm

With reference to the appearances of the flower at the times shown, which of the following can be concluded?

- The major support in the flower stalk is provided by the turgidity of the cells.
 - The rate of water uptake of the flower is higher than its rate of transpiration at 8:00 am.
 - The rate of water uptake of the flower is lower than its rate of transpiration at 2:00 pm.
- (1) only
 - (2) only
 - (1) and (3) only
 - (2) and (3) only
17. The following photomicrographs show part of the cross section of the stem and that of the root of a young dicotyledonous plant:



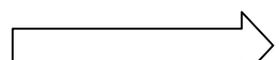
Stem



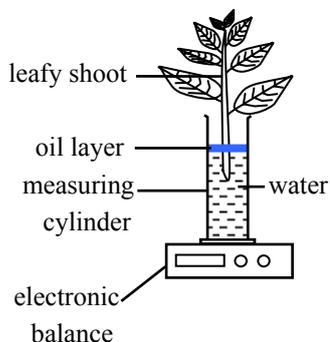
Root

Which of the following correctly shows the route by which the food from the leaves is transported via the stem to the root?

- 1 → 6 → 4
- 2 → 3 → 4
- 2 → 5 → 4
- 3 → 6 → 5



18. The diagram below shows a weight potometer used in an experiment. The leafy shoot was kept in a laboratory for 3 hours. The change in the reading of the electronic balance and the change in the volume of water in the measuring cylinder were recorded. The experiment was then repeated under the same environmental conditions with the upper surface of all the leaves of the shoot smeared with vaseline. The results are shown in the following table:



Treatment	Change in the reading of the balance (g)	Change in the volume of water in the measuring cylinder (mL)
(I) Leaves not smeared with vaseline	p	r
(II) Upper surface of all leaves smeared with vaseline	q	s

Note:

- p, q, r and s are numerical values
- mass of 1 mL of water = 1 g

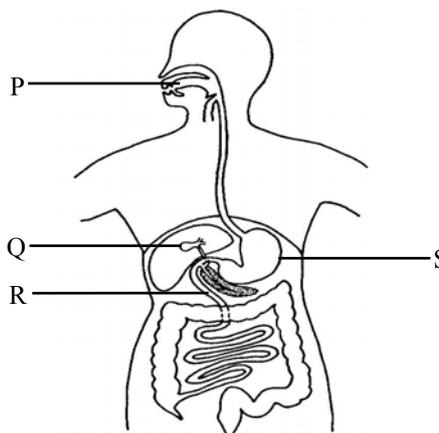
From the results of the experiment, we can calculate the amount of

- water absorbed by the shoot in Treatment (I) from $p - r$.
 - water transpired by the shoot in Treatment (II) from $r - s$.
 - water retained by the shoot in Treatment (II) from $s - q$.
 - water transpired by the lower surface of the leaves of the shoot in 3 hours from $p - q$.
19. The following shows a table listing the results of the food tests for a piece of food and a diagram of the human digestive system:

Food test	Result
Albustix paper	+
Benedict's test	+
Iodine test	-
Grease spot test	+

Key:

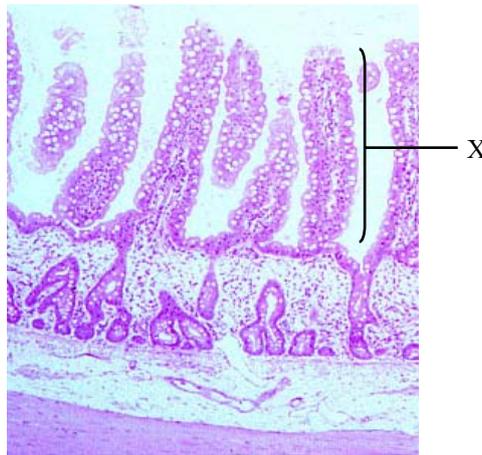
- + positive result
- negative result



In which of the labelled parts will this food be chemically digested?

- P and S only
- Q and R only
- R and S only
- Q, R and S only

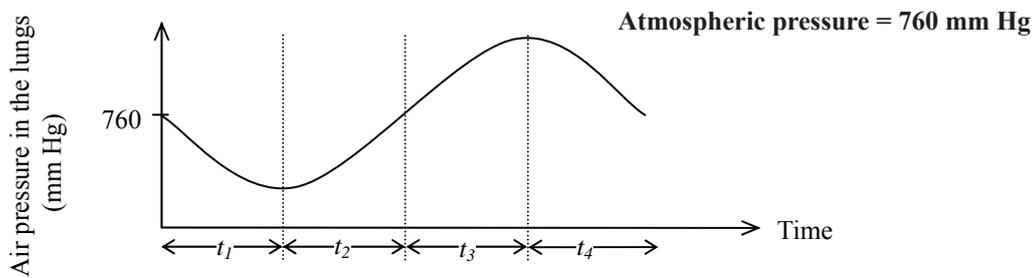
20. The following photograph shows a section of a part of the human intestine:



Which of the following is/are the function(s) of X?

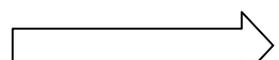
- (1) to absorb digested food
 - (2) to secrete enzymes for fat digestion
 - (3) to move the food along the intestine by peristalsis
- A. (1) only
 - B. (3) only
 - C. (1) and (2) only
 - D. (2) and (3) only

21. The following graph shows the change in the air pressure inside the lungs within a period of time:

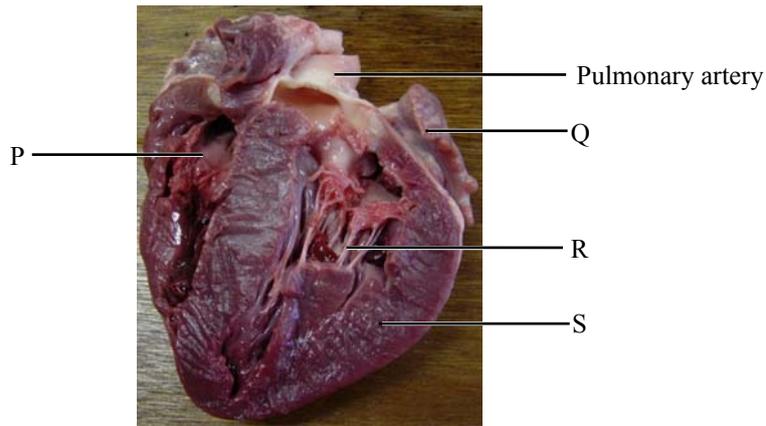


Which of the following correctly describes what happens at the specified time period?

- A. During t_1 , air leaves the lungs.
- B. During t_2 , the intercostal muscles contract.
- C. During t_3 , the diaphragm is pulled flat.
- D. During t_4 , the rib cage is moved upwards and outwards.



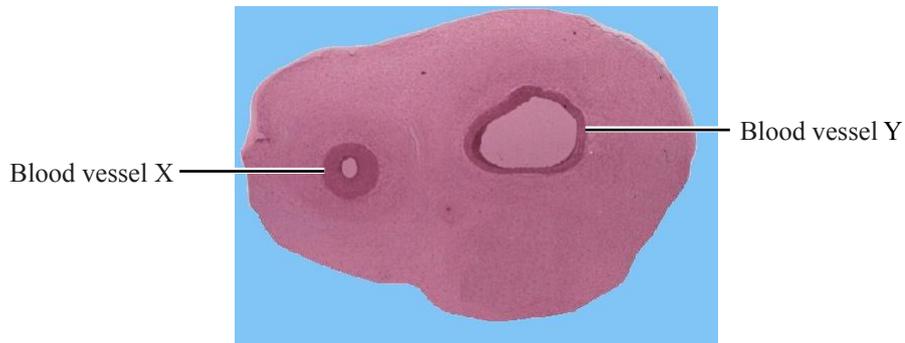
22. The following photograph shows a dissected pig's heart:



Which of the following descriptions of the labelled structures is correct?

- A. Structure P contracts to deliver blood to various parts of the body except the lungs.
- B. Structure Q receives blood from the pulmonary veins.
- C. Structure R controls the opening and closing of the valve.
- D. Structure S contracts to force the blood out of the heart through the pulmonary artery.

23. The photograph below shows the cross section of the umbilical cord of a foetus:



Which of the following descriptions about blood vessels X and Y are correct?

- (1) The blood pressure in blood vessel Y is lower than that in blood vessel X.
 - (2) There are valves along the length of blood vessel Y but not in blood vessel X.
 - (3) The blood in blood vessel Y has a lower oxygen content than that in blood vessel X.
- A. (1) and (2) only
 - B. (1) and (3) only
 - C. (2) and (3) only
 - D. (1), (2) and (3)

24. Which of the following contraceptive methods are based on the same biological principle?

- (1) using a condom
- (2) using an intra-uterine device
- (3) using a diaphragm

- A. (1) and (2) only
- B. (1) and (3) only
- C. (2) and (3) only
- D. (1), (2) and (3)

END OF SECTION A

Go on to Question-Answer Book B for questions on Section B

SECTION B

Answer **ALL** questions. Put your answers in the spaces provided.

1. For each of the infectious diseases listed in Column 1, select **one** of the methods listed in Column 2 that helps to protect people from contracting the disease. Put the appropriate letter in the space provided. (2 marks)

Column 1

Column 2

Cholera

A. using serving chopsticks and spoons at meal times

B. boiling water before drinking

Dengue fever

C. wrapping up rubbish properly before disposal

D. wearing a face mask in crowded places

E. getting rid of stagnant water

2. Digested food is absorbed into the epithelial cells of the villi. With reference to the structure of the cell membrane as illustrated by the fluid mosaic model of cell membrane, explain the following:

- (a) Fatty acids (non-polar molecules) can diffuse across the cell membrane into the epithelial cell. (2 marks)

(2 marks)

- (b) Amino acids (polar molecules) can be taken up from the intestinal lumen into the epithelial cell but cannot diffuse across the epithelial cell membrane back to the lumen. (3 marks)

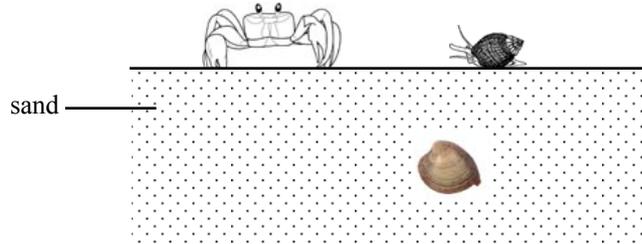
(3 marks)

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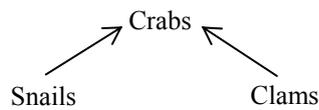
Answers written in the margins will not be marked.

3. A sandy shore community has three species: a burrowing clam, a snail, and a crab.



(a) To determine the relative abundance of these species, a student placed a quadrat on the shore and collected all the individuals on the sediment surface inside the quadrat. After counting the number of individuals of each species collected from this quadrat, he determined their relative abundance. Give **three** reasons why the student's sampling method may not reflect the actual relative abundance of these organisms. (3 marks)

(b) The feeding relationship of these three species is shown below:



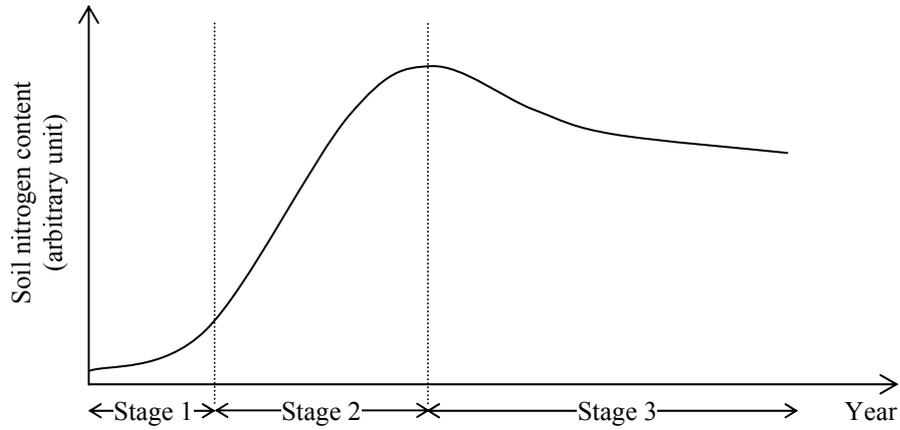
Suggest the effect on the population of crabs if a large number of clams are harvested by visitors to the shore. Explain your answer. (2 marks)
(Assume that the crabs have the same preference for snails and clams.)

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Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

6. Graph 1 shows the change in the soil nitrogen content in an area over 200 years. At the beginning of Stage 1, the area was without vegetation. Table 1 shows the relative abundance of three plant species found in this area at the different stages:



Graph 1

Plant species	Relative abundance of the plant species at the end of each stage (%)		
	Stage 1	Stage 2	Stage 3
A	95	10	5
B	5	85	20
C	0	5	65

Table 1

- (a) With reference to Table 1, state the process that accounts for the change in the relative abundance of the plant species in this area. (1 mark)

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Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

(b) The bacteria living symbiotically with plant species A and species B played an important role in causing the increase in the soil nitrogen content in Stages 1 and 2.

(i) Name the symbiotic bacteria living in plant species A and B. (1 mark)

(ii) Describe how the symbiotic bacteria and the two plant species caused the increase in the soil nitrogen content in Stages 1 and 2. (3 marks)

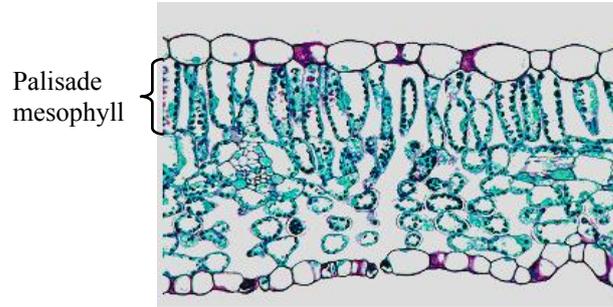
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Answers written in the margins will not be marked.

7. In some plant species, leaves that develop in shady places (shade leaves) are structurally metabolically different from leaves that grow in sunny places (sun leaves).

(a) The photomicrograph below shows the cross section of a leaf taken from a plant species grown in a shady place:



(i) With reference to **two** features observable in the photomicrograph, describe how the leaf is adapted to allow the palisade mesophyll cells to obtain the gas required for photosynthesis. (2 marks)

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(ii) The sun leaves of this plant species have a thicker cuticle than its shade leaves. Why is it important for the sun leaves to have a thicker cuticle? (2 marks)

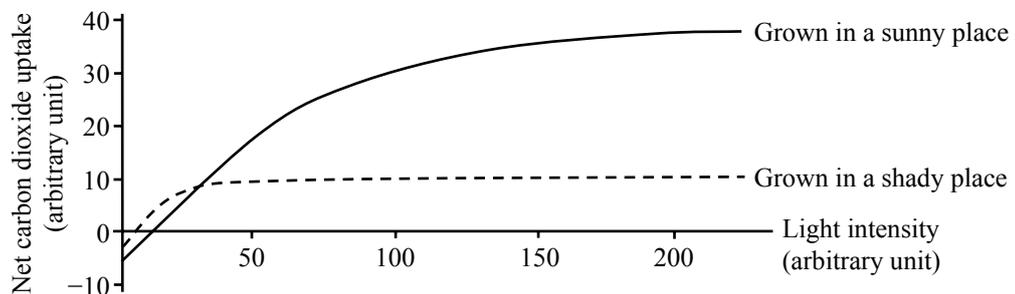
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(b) The graph below shows the net carbon dioxide uptake of two plants of species P in different light intensities. One plant is grown in a sunny place and the other is grown in a shady place.



(i) What is the implication of having a positive net uptake of carbon dioxide for a plant? (1 mark)

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Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

- (ii) From the graph, compare the compensation points of the leaves of species P grown in a sunny place and in a shady place. Hence, explain how this plant species can adapt to living in shady places. (2 marks)

- (iii) The following photographs show two potted plants, Q and R:

Plant Q



Plant R



Using hydrogencarbonate indicator solution, design an experiment to compare the compensation points of these two potted plants. Illustrate the set-up used with a labelled diagram. (5 marks)

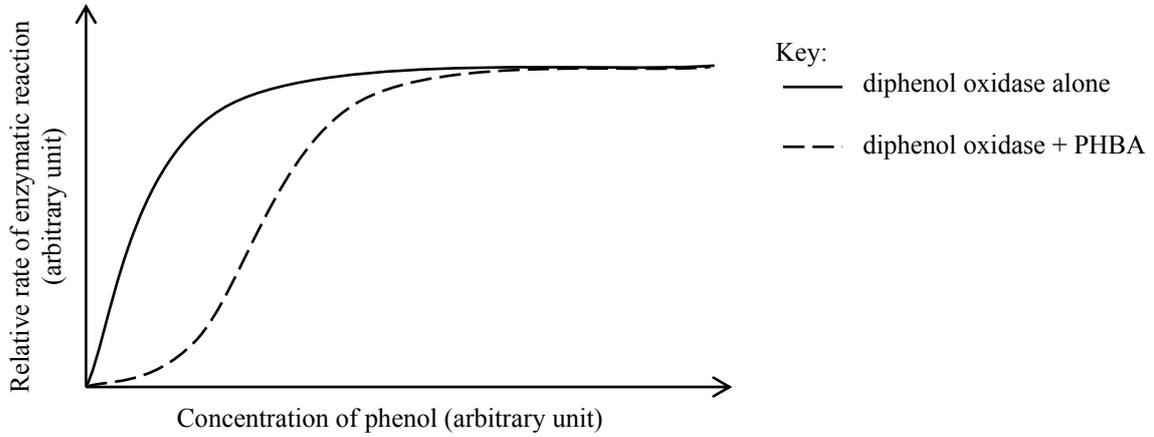
Diagram of the set-up:

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Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

8. When a slice of apple is exposed to air, it quickly turns brown. This is because the enzyme diphenol oxidase catalyzes the oxidation of phenols in the apple to dark-coloured products. In an experiment, the effect of a chemical, PHBA, on the rate of this enzymatic reaction was investigated. The experiment was carried out at the same temperature and the same concentration of diphenol oxidase was used. The results are shown in the graph below:



(a) Deduce the relationship between PHBA and diphenol oxidase. (3 marks)

(b) Draw a curve in the above graph to show the effect of PHBA on the rate of enzymatic reaction if a higher concentration of PHBA had been used. (1 mark)

(c) Suggest one other factor that should be kept constant in this experiment. Explain how this factor may affect the activity of the enzyme. (3 marks)

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Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

