

TERTIARY ENTRANCE EXAMINATION, 1992
QUESTION/ANSWER BOOKLET

Please place one of your student
identification labels in this box

BIOLOGY

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SEA STUDENT NUMBER -- In figures

In words

TIME ALLOWED FOR THIS PAPER

Reading time before commencing work: Ten minutes
Working time for paper: Three hours

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

TO BE PROVIDED BY THE SUPERVISOR

This Question/Answer Booklet comprising 35 pages and 37 questions
Separate Multiple Choice Answer Sheet
Standard Answer Book
Paper Binder

TO BE PROVIDED BY THE CANDIDATE

Standard Items: Pens, pencils, eraser or correction fluid, ruler
Special Items: A '2B' pencil for the Separate Multiple Choice Answer Sheet

IMPORTANT NOTE TO CANDIDATES

No other items may be taken into the examination room.

It is your responsibility to ensure that you do not have any unauthorised notes or other items of a
un-personal nature in the examination room. If you have any unauthorised material with you hand it
to the supervisor BEFORE reading any further.

INSTRUCTIONS TO CANDIDATES

This paper comprises three sections — A, B and C.

Marks will be allocated as follows:

SECTION A — 30 marks

SECTION B — 50 marks

SECTION C — 20 marks

In SECTION A, attempt all questions in this section, using the Separate Multiple Choice Answer Sheet. Use a '2B' PENCIL. DO NOT use a ball point or ink pen. Marks are not deducted for wrong answers.

In SECTION B, attempt all questions in this section and write your answers in the places provided in this Question/Answer Booklet. Use a blue or black PEN (not pencil) for this section.

In SECTION C, attempt one alternative from each of the questions and write your answers in the Standard Answer Book. Use a blue or black PEN (not pencil) for this section. Do NOT copy the questions when writing your answers. Merely write the number of the question in the margin.

MOST IMPORTANT

At the end of the examination make sure that your SEA Student Number is on your Question/Answer Booklet and Standard Answer Book(s).

At the end of the examination the Question/Answer Booklet must be attached to the FRONT of the Standard Answer Book(s) with the paper binder provided.

The Separate Multiple Choice Answer Sheet will be collected separately by the Supervisor.

SEE PAGE 3

SECTION A

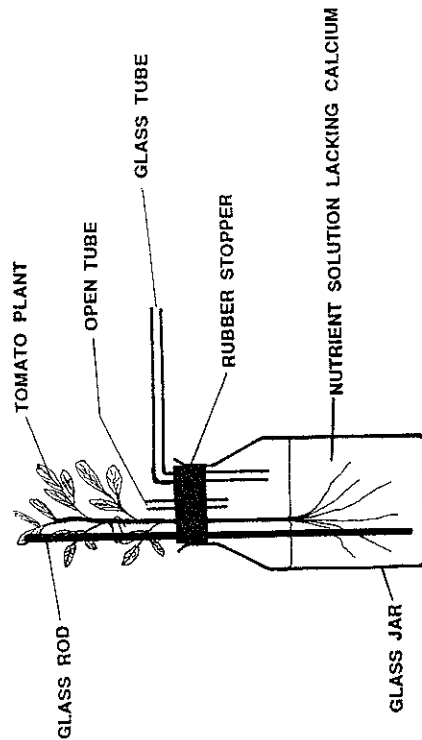
Suggested time: 40 minutes (30 marks)

Record each answer for questions 1 - 30 by marking your choice of alternatives on the Separate Multiple Choice Answer Sheet using a '2B' pencil. If you want to change an answer, rub out your first answer and mark a new one.

The Answer Sheet for Section A will be collected separately by the Supervisor.

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1. To find the effect of a calcium deficiency on the growth of tomato plants, a student set up a tomato plant in an appropriate nutrient solution as shown below.



The following were suggested by other students as ways to improve the experiment.

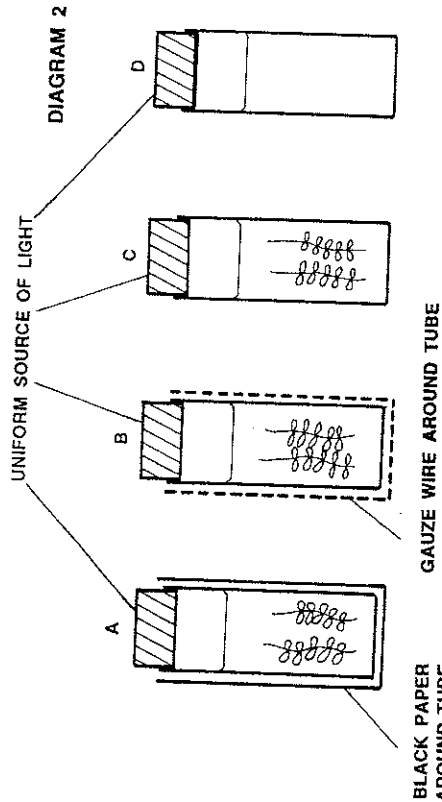
1. Set up nine more containers as above.
2. Lengthen the glass tube in each container to below the water.
3. Connect an aerator to the glass tube.
4. Have 10 more containers as above but with a complete nutrient solution.
5. Use plants other than tomato plants.

To best improve the experiment, which of the following combination(s) of the above improvements should be chosen?

- (a) 5 only.
- (b) 1, 2, 3 and 4.
- (c) 1 and 4.
- (d) 2, 3 and 5.

SEE PAGE 4

2. Four test tubes containing bicarbonate indicator solution are set up as shown in DIAGRAM 2. Test tubes A, B, and C contain an equal amount of the green aquatic plant *Hydrilla*.



The bicarbonate indicator solution changes colour as shown below.

Colour of bicarbonate indicator solution	Carbon dioxide concentration
red	less than 0.03%
orange	0.03%
yellow	greater than 0.03%

At the beginning of the experiment, the colour of the bicarbonate indicator solution was orange in all of the test tubes.

The tubes were left for 40 minutes and the colour observed.

The most likely colours observed in the 4 tubes would be:

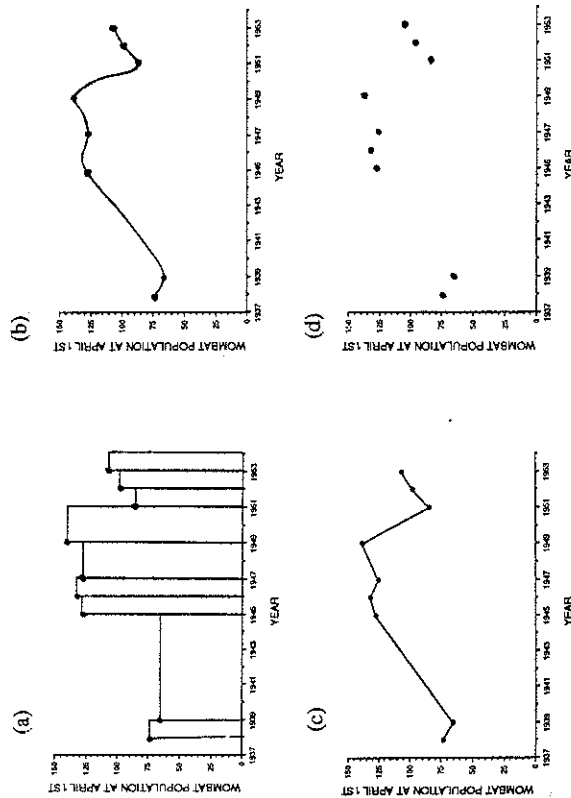
Tube	A	B	C	D
(a)	yellow	orange	red	orange
(b)	yellow	red	orange	yellow
(c)	red	yellow	yellow	orange
(d)	orange	yellow	yellow	red

SEE PAGE 5

3. The populations of wombats (numbers of individuals) in a reserve on April 1st over a number of years were as follows:

YEAR	WOMBAT POPULATION
1938	73
1939	65
1945	127
1946	131
1947	125
1949	138
1951	84
1952	97
1953	106

Which one of the graphs below most appropriately represents the above data? (You may assume that the points for each graph have been accurately plotted).



SEE PAGE 6

4. Some animals of the ocean zooplankton are coloured red. This may protect them from excessive sunlight which can be quite harmful. Another mechanism to avoid sunlight is to move downward into deeper water depths during the daytime.

It is reasonable to predict that

- in the daytime, more red coloured animals would be found in the darker waters at depth from the surface.
- in the daytime, more animals caught near the surface would be red coloured than those caught from deeper water.
- at night, more of the animals caught near the surface would be red coloured than those caught at greater water depths.
- the red coloured animals would move more during each 24 hours than the uncoloured ones.

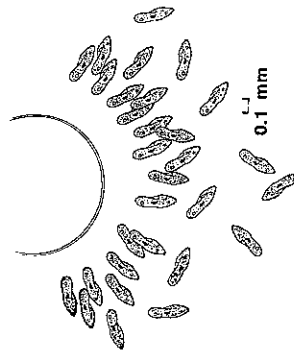


DIAGRAM 5

5. A drop of culture solution containing the single celled organism *Paramecium* was mounted on a microscope slide in such a way that bubbles of carbon dioxide gas were included. DIAGRAM 5 shows the distribution of the organisms around one bubble.

This behaviour of *Paramecium* suggests that

- it prefers to live near the surface of the culture solution.
- carbon dioxide inhibits the activity of the organism.
- it can detect carbon dioxide in solution in water.
- it is using carbon dioxide in its metabolic activity.

DIAGRAM 6



6. The size to which amoebas (shown here in DIAGRAM 6) can grow is limited, since as they get larger

- their volume increases and the lack of a nucleus affects their functioning.
- they can trap only small amounts of food without definite limbs.
- their volume increases faster than their surface area.
- they become more active to dispose of wastes.

SEE PAGE 7

7. Twelve hen eggs were placed in dilute hydrochloric acid for 24 hours to dissolve away the shell and expose the membrane. They were weighed, and then four of them were placed in each of three different liquids and weighed again after 10 minutes, with the following results.

Egg	Average Weight of Eggs (g)	
	Before placement in liquid	After soaking for 10 minutes
1	62.0	63.2
2	59.6	59.7
3	60.3	59.1

Which of the following is consistent with these results?

- Egg 1 was placed in a concentrated salt solution.
- Egg 2 was placed in dilute salt solution.
- Egg 2 was placed in distilled water.
- Egg 3 was placed in distilled water.

8. Mitotic cell division occurs in animals and plants. The complexity of the phases involved makes sure that

- every cell produced has a nucleus with genes in it.
- each daughter cell has half of the genes of the original cell.
- the four resulting daughter cells have the same gene complement.
- each daughter cell has an identical copy of the mother cell's genetic material.

9. DIAGRAM 9 below is a model of the action of an enzyme molecule in the formation of a product.

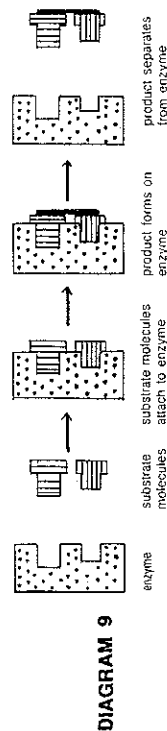


DIAGRAM 9

The model is referred to as the 'Lock and Key' model because

- the shapes of the substrate molecules match the surface of the enzyme molecule like a key matches a lock.
- the enzyme molecule is the key to the reaction proceeding.
- the substrate molecules must match each other like a lock matches a key.
- the substrate molecules are said to lock onto the enzyme molecule.

SEE PAGE 8

10. In an experiment, saliva was mixed with a starch suspension. Samples of the mixture were placed in water baths at varying temperatures for 15 minutes and the amount of sugar released in each was determined to obtain the following results.

Temperature °C	0	10	20	30	40	50	60	70	80
Units of sugar	12	36	65	90	90	60	30	4	2

These data indicate that

- (a) the activity of the enzyme increases as the temperature rises.
 (b) the enzyme is most effective at a temperature of 40° C.
 (c) at temperatures higher than 30° C, the enzyme molecules begin to deform.
 (d) the activity of the enzyme decreases at temperatures above 40° C.

11. Purple coloured proteins in the plasma membrane of certain halophilic (salt loving) bacteria are involved in the transport of protons (H^+) to the outside of the cell, using light. The protons diffuse back into the cell through the enzyme ATPase which is embedded in the plasma membrane (see DIAGRAM 11).

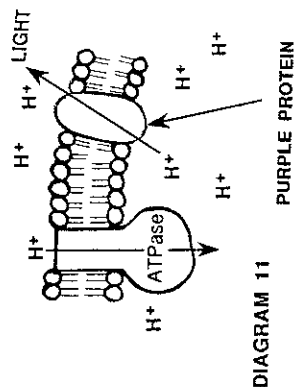


DIAGRAM 11

PURPLE PROTEIN

Which of the following is the best statement concerning the movement of protons across the plasma membrane of the bacterium? Movement of a proton

- (a) from inside to outside on purple protein probably releases energy.
 (b) from inside to outside on purple protein probably uses energy.
 (c) from outside to inside through ATPase probably uses energy.
 (d) from outside to inside through ATPase probably releases energy.

12. Which of the following would **not** be required during daytime by the cells of both a green alga and a fungus?

- (a) High energy compounds.
 (b) Water.
 (c) Oxygen.
 (d) Carbon dioxide.

13. The structure of xylem tissue is significant in enabling a tree to transport water from the soil to its topmost leaf. This is because

- (a) the living xylem cells form a continuous pathway from the roots to the leaves.
 (b) the high cohesive forces between water molecules causes them to adhere to the cellulose in the walls of the xylem tubes.
 (c) their cellulose walls generate forces of adhesion, and the cohesive forces in the water keep the water column continuous.
 (d) water is transported by active transport from one xylem cell to the next.

SEE PAGE 9

Questions 14 and 15 are based on the following information. A coleoptile is the protective sheath surrounding the growing shoot in a grass plant such as wheat. A number of wheat coleoptiles were treated as shown below.

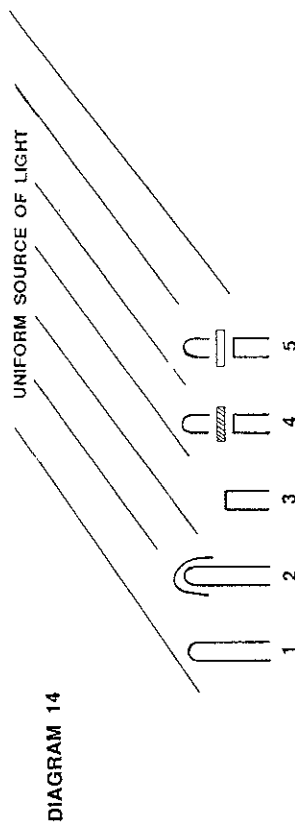


DIAGRAM 14

Key: 1. whole coleoptile

2. tip covered by aluminium foil

3. tip cut off

4. tip cut off and replaced on aluminium foil

5. tip cut off and replaced on agar

14. What results would you predict?

- (a) Coleoptiles 2 and 4 will bend away from the light.
 (b) Coleoptiles 1 and 3 will bend towards the light.
 (c) Coleoptiles 2 and 4 will not grow.
 (d) Coleoptiles 1 and 5 will grow towards the light.

DIAGRAM 15.1



15. Other possible experimental treatments could be:

- (1) to include a coleoptile where the tip was cut off and replaced, as shown in DIAGRAM 15.1.
 (2) to have replicates of all the coleoptiles.
 (3) to have a coleoptile with its base covered in aluminium foil.
 (4) to include a coleoptile where the tip was cut off and placed on the edge of the base as shown in DIAGRAM 15.4.

DIAGRAM 15.4

The experiment investigating the mechanism by which oat coleoptiles respond to light could best be improved by including the following treatments

- (a) 1, 2, 3 and 4.
 (b) 1, 2 and 4.
 (c) 2 and 4.
 (d) 2 only.

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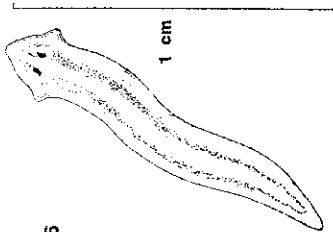


DIAGRAM 16

16. DIAGRAM 16 shows a flatworm which moves on the surface of mud at the bottom of a pond. It can orientate with respect to gravity by having touch receptors on its ventral and dorsal surfaces, and to light through light receptors, "eyes", on the dorsal surface. Other means of sensing gravity include statocysts - hollow structures with a freely movable grain of sediment inside.

Now consider a different species of flatworm which swims through water. How could it orientate with respect to gravity? By having

- more touch receptors on the dorsal than ventral surface.
- more touch receptors on the ventral than dorsal surface.
- only statocysts, and no touch receptors on the body surface.
- light receptors only on the dorsal surface of the body.

17.

Cockroaches exhibit rhythmic behaviour. This means that they are normally active at night but inactive during the day. If a cockroach is kept in continuous bright light, it gradually loses such rhythmic activity. A cockroach which had lost its rhythmic activity was surgically attached to one having rhythmic activity so that their bloods mingled. The pair was then placed in continuous light and both animals showed the rhythmic activity pattern for the next three days.

Which of the following statements is the best explanation for these observations?

- Rhythmic activity is dependent on the presence of certain chemicals carried in the blood.
- The nervous system is necessary for the development of rhythmic activity in cockroaches.
- The rhythmic activity of cockroaches is determined by environmental stimuli.
- The rhythmic activity of cockroaches is a form of communication between individuals.

18. It has been suggested that Henry the 8th of England married several women because he was determined to have a son, and his first three wives failed to produce one. His assumption that the fault lay with the women was

- reasonable considering the low survival rate of babies in the 16th Century.
- false since more baby boys than girls are miscarried.
- reasonable since the health of the mother is very important in determining the survival of the baby.
- false since the sex of the baby is determined at conception by the father's sperm.

SEE PAGE 11

19. DIAGRAM 19 below illustrates the results of a mating between two Blue Andalusian fowls.

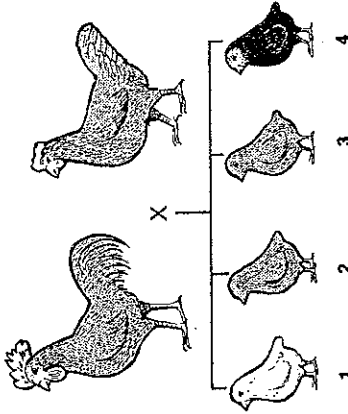


DIAGRAM 19

The genotype for chick No. 1 can be represented by

- white.
- heterozygous.
- WW.
- Ww.

20.

New hydrangea plants may be produced by cuttings or from the germination of seeds. The colour of their flowers may be affected by soil type. In acid soil, blue flowers result, while in alkaline soils pink flowers result.

Which of the following would produce the greatest variation in the offspring?

- Cuttings from pink flowering hydrangeas planted in alkaline soil.
- Cuttings from pink flowering hydrangeas planted in acid soil.
- Seeds from a cross between blue and pink flowering hydrangeas planted in neutral soil.
- Seeds from a cross between two blue flowering hydrangeas planted in acid soil.

21.

Nicotiana sylvestris ($2n = 24$) and *N. tomentosiformis* ($2n = 24$) are two species of wild tobacco plant closely related to the commercial species *N. tabacum*. It is possible to develop a plant very similar to *N. tabacum* by crossing *N. sylvestris* with *N. tomentosiformis* and treating with colchicine the F1 of this cross. (Colchicine blocks the formation of the spindle involved in moving chromosomes in cell division). The plants then develop into *N. tabacum* look-alikes.

Based on this information, it would be reasonable to hypothesise that the species *N. tabacum*

- originated as a result of hybridisation between *N. sylvestris* and *N. tomentosiformis*.
- separated into two species *N. sylvestris* and *N. tomentosiformis*.
- originated when some *N. sylvestris* plants became geographically separated from the main population.
- originated through a change in chromosome number.

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22. At the beginning of this century, a farmer in North America was surprised and pleased when some lambs born into his flock of sheep developed with much shorter legs than normal. The short legged sheep, called Ancon sheep, could not jump over his fences. This new characteristic was the result of

- careful breeding and selection of suitable characteristics.
- independent assortment of the genes in the parents of the lambs.
- a change in the genetic code in an ancestor of the lambs.
- chromosome abnormalities in a previous generation.

23. The "Greenhouse Effect" is the popular name which has been given to

- solar heat trapped near the Earth's surface by carbon dioxide, methane and other gases in the air.
- the poisoning of air in big cities by waste gases from motor vehicles.
- the removal of ozone from the air by a chemical reaction with chlorine compounds.
- the damage caused to ecosystems by rain which contains acid formed from factory waste gases.

24. The numbat (*Myrmecobius fasciatus*) is one of the wildlife emblems of Western Australia. The size of the numbat population declined over a period of several decades, and consequently a considerable effort is being expended now to increase their numbers to save numbats from extinction. To be effective, the programme must also involve

- preservation of genetic variation.
- reduction in numbers of competitors.
- reduction in environmental pollution.
- restoration of natural numbat habitat.



25. The Gaia hypothesis of James Lovelock states that "ever since life first evolved on earth, the biota (all living forms) have, by their activities, been regulating the physical and chemical properties of the Earth's surface environment".

Which of the following does not support this hypothesis?

- Atmospheric carbon dioxide levels have been lowered due to the extensive growth of coral reefs.
- The amount of light given out by the sun has increased by 30% over the last 4 000 years.
- The amount of carbon dioxide and oxygen produced by the phytoplankton in the oceans of the world is related to total phytoplankton abundance.
- The increased combustion of fuels to provide warmth, light and cooking has led to an increase in atmospheric carbon dioxide levels.

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26. In the early days of European colonisation of Western Australia, quokkas (*Setonix brachyurus*) were abundant and widespread throughout the south west of Western Australia. Now, quokkas occur in a few remnant populations in south western Australia.

Which of the following would not have led to a decline in the quokka population?

- Rainfall in south western Australia has fallen 22% since the 1930s.
- The introduction of sheep and rabbits.
- An increase in land use for agriculture.
- The construction of boundaries such as fences across much of the area.

27. In a study of nutrient cycling in a eucalypt forest, Dr P W Attiwell obtained the data summarized in DIAGRAM 27 below.

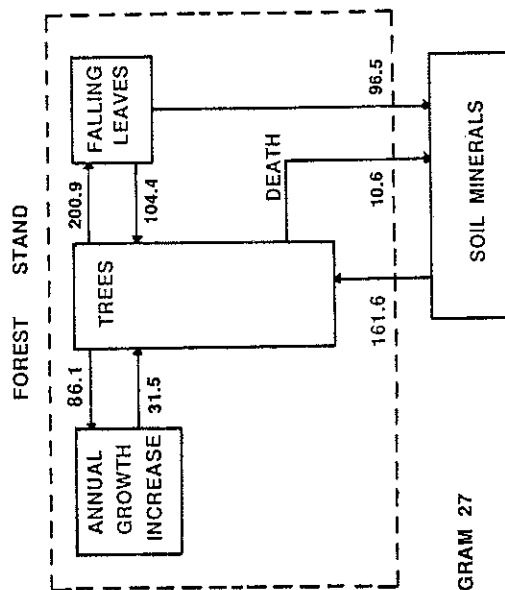


DIAGRAM 27

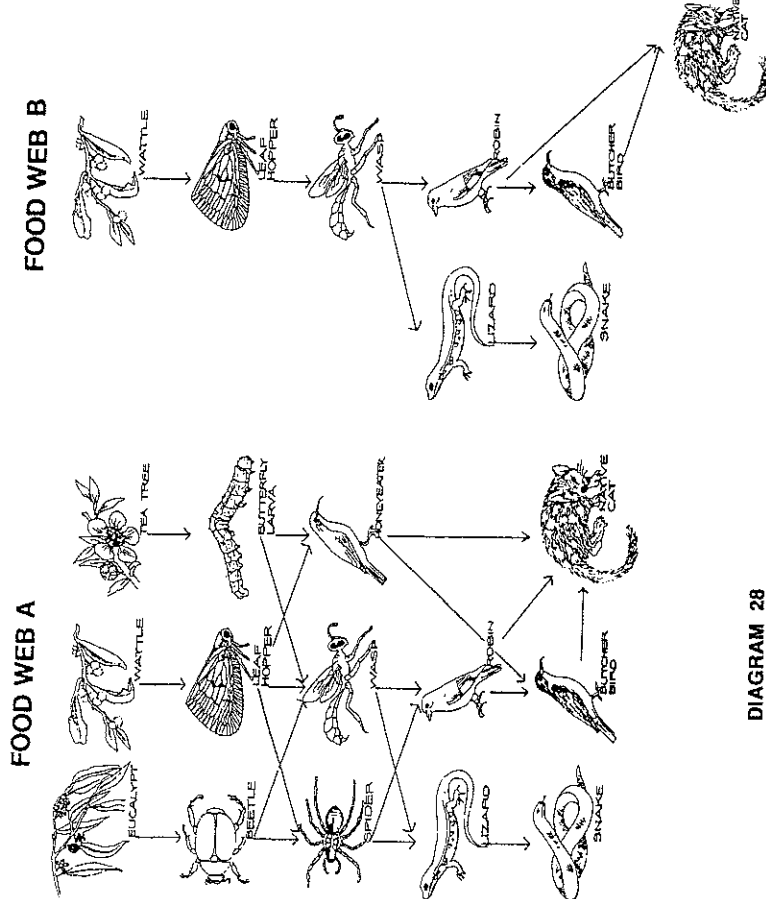
Cycling processes return 107.1 mg/m²/year of phosphorus to the soil but the forest stand was using 161.6 mg/m²/year of phosphorus.

What is the most likely source of the additional 54.5 mg/m²/year of phosphorus?

- Minerals in rain.
- Input from other ecosystems.
- Decomposition of rock minerals.
- Animal matter.

SEE PAGE 14

28. This question relates to food web A and food web B illustrated in DIAGRAM 28 below.



If the environment in both ecosystems was changed so that the leaf hoppers became extinct, it is most likely that

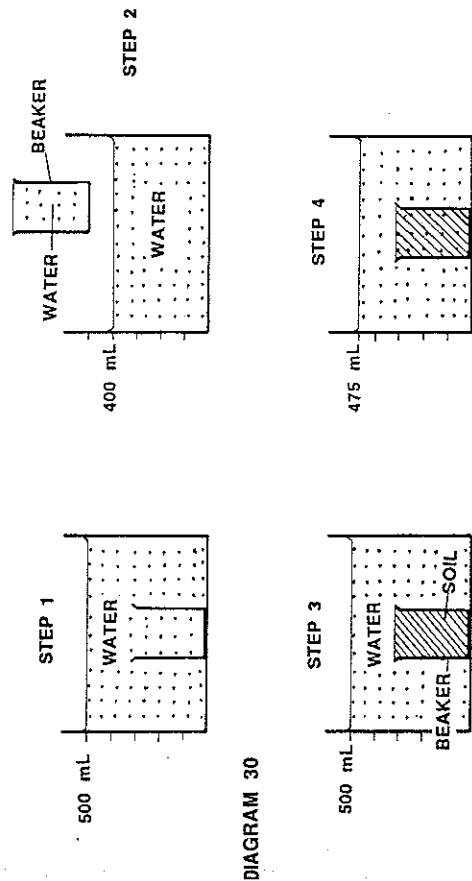
- the numbers of robins in the area covered by food web B would decrease.
- food web A will be most affected because of the greater number of tea trees.
- food web A will be most affected because of its greater range of organisms.
- the numbers of spiders in the area covered by food web A would increase.

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29. The introduced European blackberry is not eaten by many Australian animals. It has taken over large areas of bushland with the result that not only have the native plants disappeared but also the animals which depend on them for food have been much reduced in numbers. The removal of the blackberry and its replacement with indigenous species needs to be done in stages so that

- food is always available for native animals.
- shelter is available for wildlife.
- the biodiversity of the community is maintained.
- salinity problems will not develop.

30. In measuring the amount of air in soil, four steps were followed as illustrated in DIAGRAM 30 below, using the same beakers throughout.



The % of air in the soil sample is

- $\left(\frac{475 - 400}{500} \times \frac{100}{1} \right) \%$
- $\left(\frac{475 - 400}{475} \times \frac{100}{1} \right) \%$
- $\left(\frac{500 - 475}{500 - 400} \times \frac{100}{1} \right) \%$
- $\left(\frac{475 - 400}{500 - 400} \times \frac{100}{1} \right) \%$

SEE PAGE 16

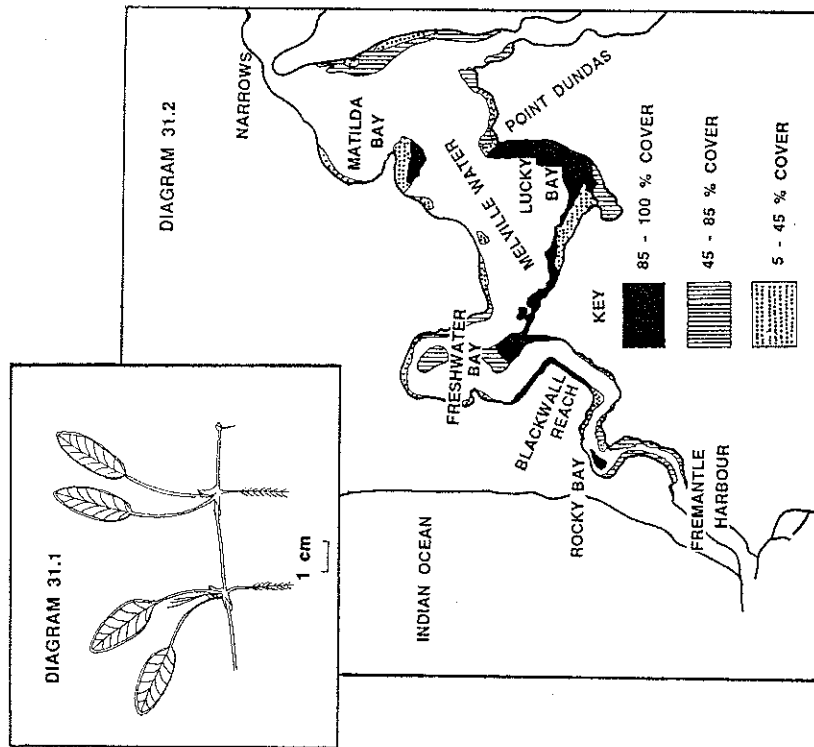
SECTION B

Suggested time: 90 minutes (50 marks)

Attempt all questions in this section. Write your answers in the spaces provided. Candidates MUST use a black or blue pen or biro when answering Sections B and C

31. (14 marks)

The seagrass *Halophila ovalis* comprises leaves, rhizomes (underground stems) and roots (see DIAGRAM 31.1 below). The species occurs in the Swan River Estuary, where its distribution between the mouth of the Estuary and the Narrows is shown below in DIAGRAM 31.2.



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31. (continued)

Dr Karen Hillman studied the ecology of *H. ovalis* in this water body, and found that in single species stands of uniform density the biomass of seagrass can become 120 g dw/m² (dry weight in grammes per square metre) by late summer, and achieve a productivity of 40 g dw/m²/day in summer.

(a) Explain the differences between biomass and productivity (2 marks)

(b) Plants are producers of food and oxygen. Identify two other ways in which *H. ovalis* is important in the ecology of the Swan River Estuary. (2 marks)

Dr Hillman also found that in shallow water, the productivity per square metre of *H. ovalis* was five times higher than was the productivity of phytoplankton in the same area. However, in the total area of the Swan River Estuary, *H. ovalis* fixes only about one quarter of the mass of carbon that is fixed by phytoplankton.

(c) Explain the difference in the productivity data above. (1 mark)

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31. (continued)

The Swan River Estuary becomes filled with sea water in summer. In winter, there is a significant input of fresh water into the middle and upper reaches of the estuary. Seasonal changes in biomass and productivity of *H. ovalis* in the Swan River Estuary are illustrated in DIAGRAMS 31.3 A and 31.3 B respectively.

Seasonal changes in the biomass of *Halophila ovalis* in a typical seagrass bed in the Swan river estuary.

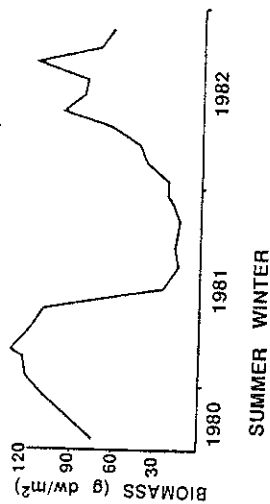


DIAGRAM 31.3 A

Seasonal changes in the productivity of *Halophila ovalis* in a typical seagrass bed in the Swan River estuary.

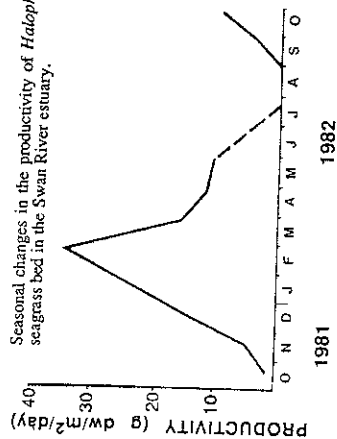


DIAGRAM 31.3 B

(d) Identify one reason for the reduction in biomass in winter.

(1 mark)

(e) Identify four factors which could cause the annual change in productivity. (2 marks)

31. (continued)

Greenhouse predictions for the southwestern corner of the continent include increased storminess in summer, and increased dryness in winter.

(f) If these predictions are realised, identify two possible consequences concerning the level of productivity of *H. ovalis* throughout the year. (2 marks)

(g) Suggest four factors which should be considered in setting aside a portion of the estuary as a conservation area (flora and fauna reserve). (2 marks)

The temperature of the water over the *Halophila* beds in the Swan River Estuary in summer may reach 28 °C whereas in winter it may fall to 10 °C. It is suggested that plants exposed to a temperature range of this magnitude might have two separate enzyme systems which operate at different optimal temperatures.

(h) Explain why this arrangement of enzymes might be an advantage to the plant. (2 marks)

32. (11 marks)

DIAGRAM 32.1 shows the same cell drawn under two different magnifications. In DIAGRAM 32.1.A, the microscope was set at low power and the field of view was 4.2 mm. DIAGRAM 32.1.B shows a drawing of the same cell under higher power.

DIAGRAM 32.1

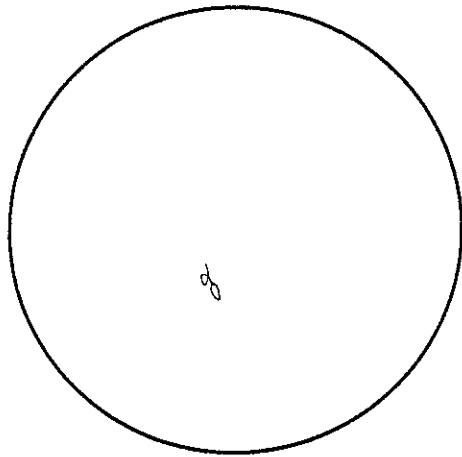


DIAGRAM 32.1 A

(a) Select the label which identifies the:

cell membrane: _____

flagellum: _____

endoplasmic reticulum: _____

Golgi bodies: _____

(b) In a living cell, which of the following structures (A - D) would you expect to be most active when _____ (2 marks)

- i) the cell is moving fast? _____
- ii) the cell is beginning to divide? _____
- iii) the cell is exposed to light? _____
- iv) the cell is transporting materials? _____

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32. (continued)

(c) i) What magnification was used to produce Diagram 32.1.A? (0.5 mark)

ii) What is the real length of the specimen drawn in Diagram 32.1.A? (1 mark)

iii) How long would the specimen appear at 400 \times magnification? (0.5 mark)

(d) Structure E stained blue with methylene blue. (0.5 mark)
Name structure E.

Structure D when observed in a living cell in a garden plant initially stained blue-black with a particular stain. The cell was kept alive in a cupboard for a number of days, following which no staining reaction occurred with the same stain.

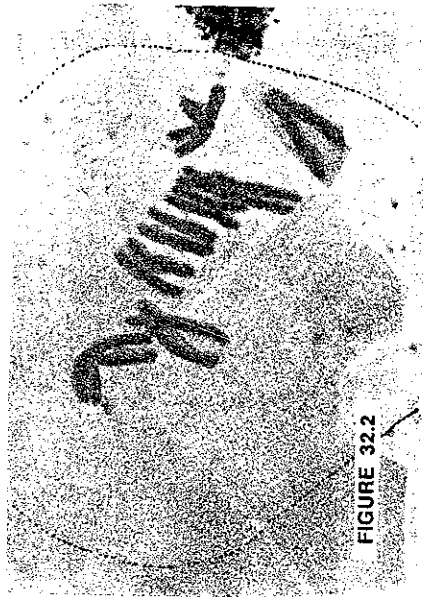
(e) i) Name the stain used. (0.5 mark)

ii) Explain why the stain did not produce a result in the second test. (1 mark)

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32. (continued)

FIGURE 32.2 shows a cell dividing.



For this cell:

(f) i) What is the haploid number? (1 mark)

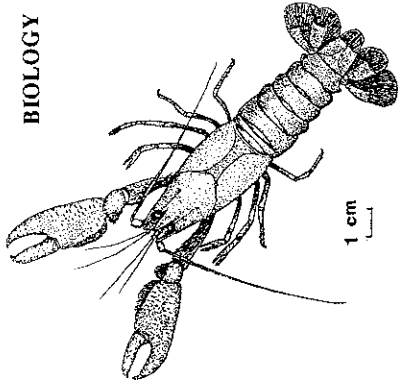
ii) What stage of cell division is shown in FIGURE 32.2? (0.5 mark)

iii) Identify three events which you would expect next to happen in the cell? (1.5 mark)

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33. (12 marks)

Many farmers from the wheatbelt of Western Australia grow freshwater crayfish in their farm dams. Crayfish are a popular gourmet item. The crayfish being cultured by the farmers belong to the species *Cherax destructor* which was introduced into Western Australia from Victoria.



The water of many farm dams is often quite turbid. There is reason to believe the crayfish spend most of the day partially buried in sediments near the bottom of the pond, and after dusk move to the shallow water around the edge of the pond.

(a) State an hypothesis to account for the daily pattern of movement. (1 mark)

(b) Plan an experiment to test this hypothesis. State the variable you would manipulate in your experiment, and also describe the response you would expect. (4 marks)

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33. (continued)

- (c) If the farmer has knowledge on the number of crayfish in the dam, what further information would be required to evaluate how many specimens might be cropped each year to leave a sustainable population in the dam. (1 mark)

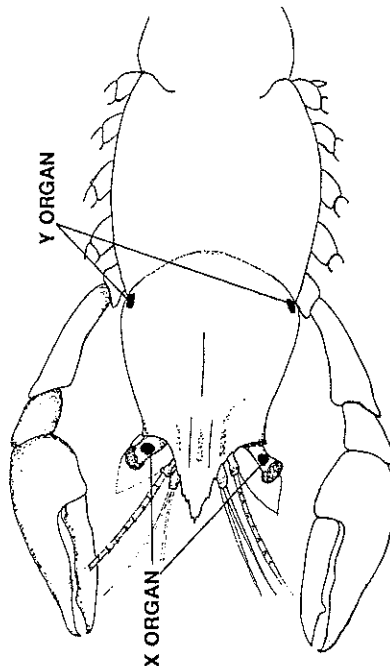
- (d) During the winter, crayfish are often seen at night in large numbers near the edges of farm dams. They are slow moving and covered in green slime; suggest a reason for their slow movement. (1 mark)

The species *C. destructor* was sampled throughout its range of distribution in Western Australia and it was concluded that the species in this State is derived from one founder stock.

- (e) Describe the kind of evidence which would have been used to reach this conclusion. (1 mark)

In order to grow, crayfish moult, that is they replace their present exoskeleton with one slightly larger. There are several organs (shown in DIAGRAM 33.1) involved in the secretion of substances which control growth in crayfish.

DIAGRAM 33.1



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33. (continued)

Light activating the X organ in the eyestalk causes the release of substance A which circulates in the blood and inhibits the activity of the Y organ.

The Y organ releases substance B which induces moulting of the exoskeleton.

- (f) What name would you give to the two substances A and B released from these organs? (0.5 mark)

- (g) What is the most likely effect on growth in crayfish which are exposed to continuous light? (1 mark)

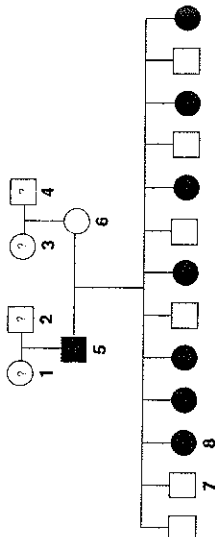
- (h) Under what conditions would you achieve maximum growth rate in crayfish? (1.5 marks)

- (i) Predict the consequences for crayfish growth of removing both eyestalks. (1 mark)

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34. (6 marks)

The pedigree for a genetically determined disease in mice is shown below. Shaded individuals have the disease. The phenotypes of individuals 1-4 are not known.



- (a) On the basis of the cross between individuals 5 and 6, a student suggests that the disease is inherited as a sex-linked dominant character. Give one feature of this pedigree that is consistent with the student's suggestion. (1 mark)

- (b) If the student were correct, what are the possible phenotypes of individuals 1, 2, 3, and 4? For each individual, state whether it *has the disease, does not have the disease*, or whether it is *impossible to decide*. (2 marks)

Individual 1: _____

Individual 2: _____

Individual 3: _____

Individual 4: _____

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34. (continued)

A second student is of the view that the disease is inherited as an autosomal dominant character. To decide between the two hypotheses the two students agree to cross individual 7 with individual 8.

- (c) Using **D** to represent the allele for the dominant (disease) trait and **d** to represent the allele for the recessive (normal) trait, give the genotypes of individuals 7 and 8 under each hypothesis. (2 marks)

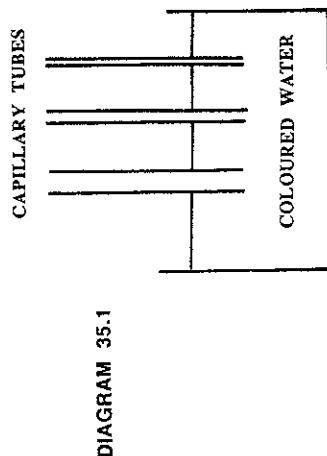
	Genotype if sex-linked dominant	Genotype if autosomal dominant
Individual 7		
Individual 8		

- (d) Can this cross distinguish between the two hypotheses? Explain your answer. (1 mark)

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35. (7 marks)

Water transport in plants involves the processes of capillarity, adhesion, cohesion, root pressure and evapotranspiration. This question looks at various aspects of these processes.



- (a) In DIAGRAM 35.1 above, draw lines to indicate the relative height of the coloured water in each of the three tubes. (1 mark)
- (b) The distance between the fibres in the wall of a leaf is approximately 0.05 micrometres; the average diameter of xylem vessels is between 10 and 200 micrometres; while the diameter of a root hair is about 20 micrometres.
In which of these structures would you expect the most significant forces involved in water transport to be developed? (1 mark)

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35. (continued)

Examine the DIAGRAM 35.2 (A, B and C) below showing 3 potometers.

DIAGRAM 35.2 A

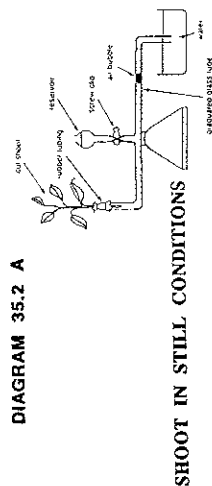


DIAGRAM 35.2 B

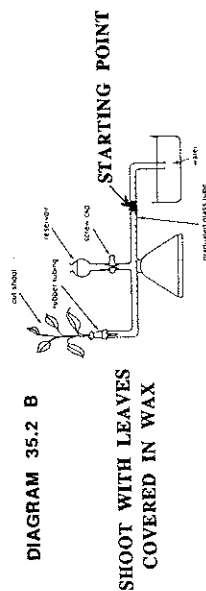
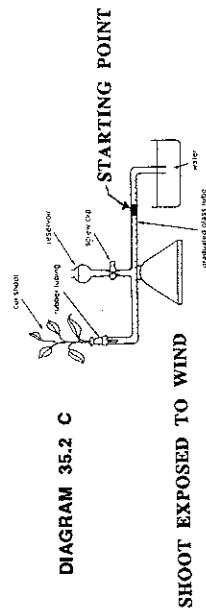


DIAGRAM 35.2 C



- (c) i) Mark clearly on DIAGRAMS 35.2 (B and C) the positions where you would expect the bubbles to be after 30 minutes. (1 mark)
- ii) Explain the results for each of:
Potometer B (1 mark)

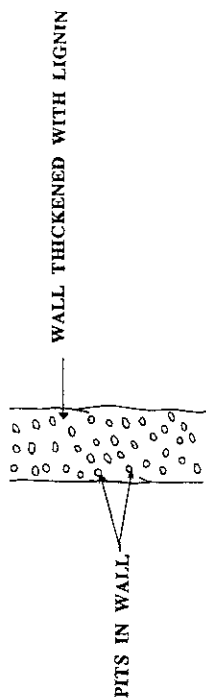
Potometer C

(1 mark)

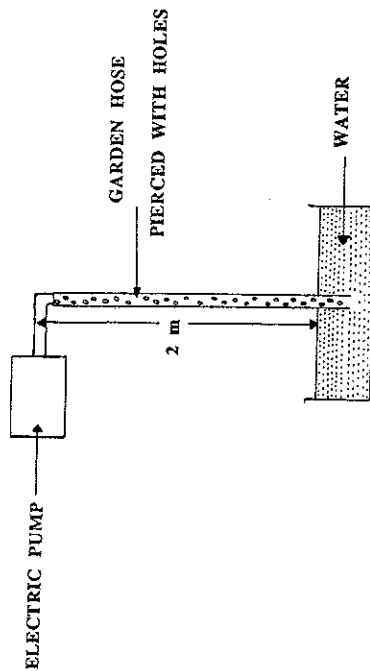
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35. (continued)

A biology student discovered that many of the xylem vessels which conduct water up the stems of plants have the following structure.



The student made up a model of a water transport system in a higher plant as shown below.



The garden hose represented a column of xylem vessels. To represent the pits in the thickened wall, the student pierced the hose many times along its length with a sharp nail. The pump was then turned on to draw water up the tube, but the water did not rise up the hose. Instead, the pump only sucked air in through the holes in the wall of the hose.

(d) Briefly explain what is wrong with the student's model.

(2 marks)

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SECTION C

Suggested time: 50 minutes (20 marks)

There are two alternatives to each question. Answer ONE alternative from each question.

USE THE SEPARATE ANSWER BOOK FOR SECTION C ANSWERS

Each question is worth 10 marks. Answer both questions in essay form. Where possible, support your answers with labelled diagrams. Two marks may be deducted from each answer which is poorly presented, set out in point form or written with other than a blue or black pen or biro.

36. EITHER

- (a) Organisms respond, by a variety of structural, physiological and behavioural methods, to changes in environmental factors such as light intensity, temperature, water concentration, and carbon dioxide concentration.

Discuss TEN examples to show how plants or animals respond to changes in all of these factors. (10 marks)

OR

- (b) The processes of photosynthesis and respiration are important for the transfer of energy between living cells and their environment.

Describe the processes of photosynthesis and respiration. In your answer you should refer to the following: the raw materials used, the structure and function of the cell organelles involved in each process, the energy transfers which occur, the end products formed, and how changes in the environment of the cell may affect the processes. (10 marks)

(10 marks)

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37. EITHER

DIAGRAM 37 a

- (a) The structure of forests provides many feeding opportunities which birds exploit by means of specialized foraging adaptations.

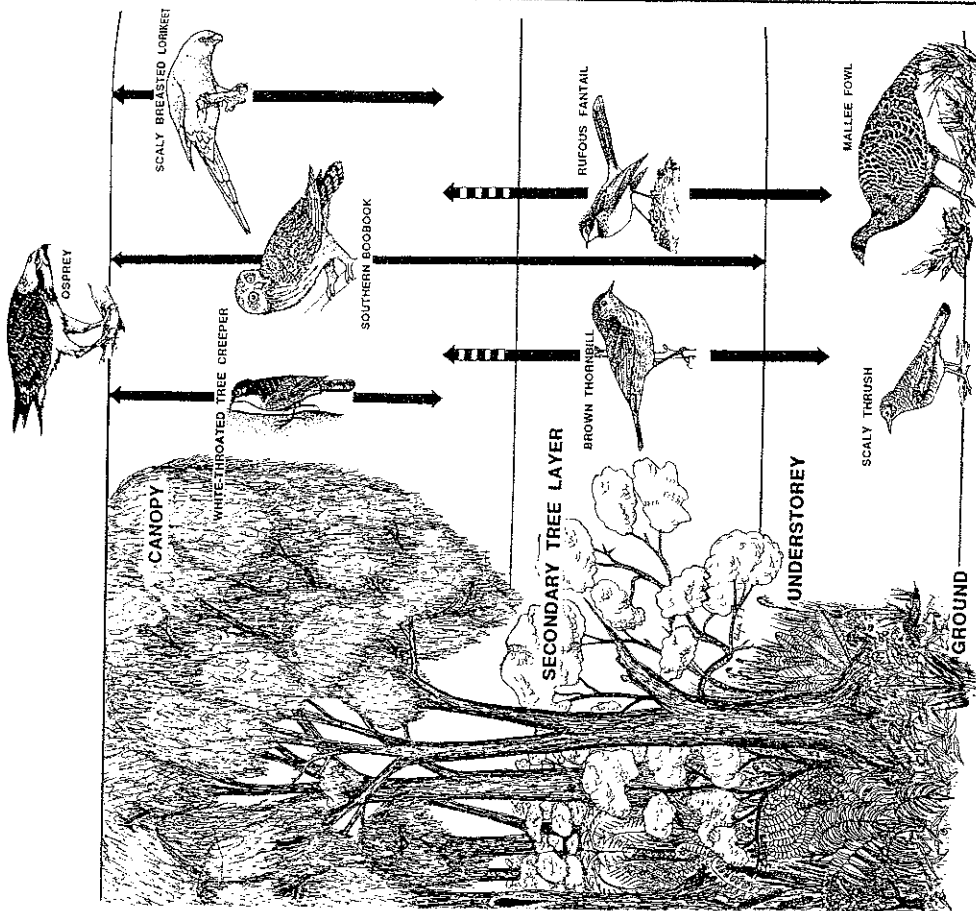
i) By reference to DIAGRAM 37a opposite of a eucalypt forest from eastern Australia, describe the possible differences in the feeding patterns of the birds shown. (5 marks)

ii) Write an account to explain how the different species of birds might have acquired the different body forms evident in DIAGRAM 37a. (5 marks)

NOTE CAREFULLY

In DIAGRAM 37a:

- birds are not drawn to the same scale;
- arrows indicate feeding range;
- unbroken portions of the arrows indicate the usual feeding range.



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37. (continued)

OR

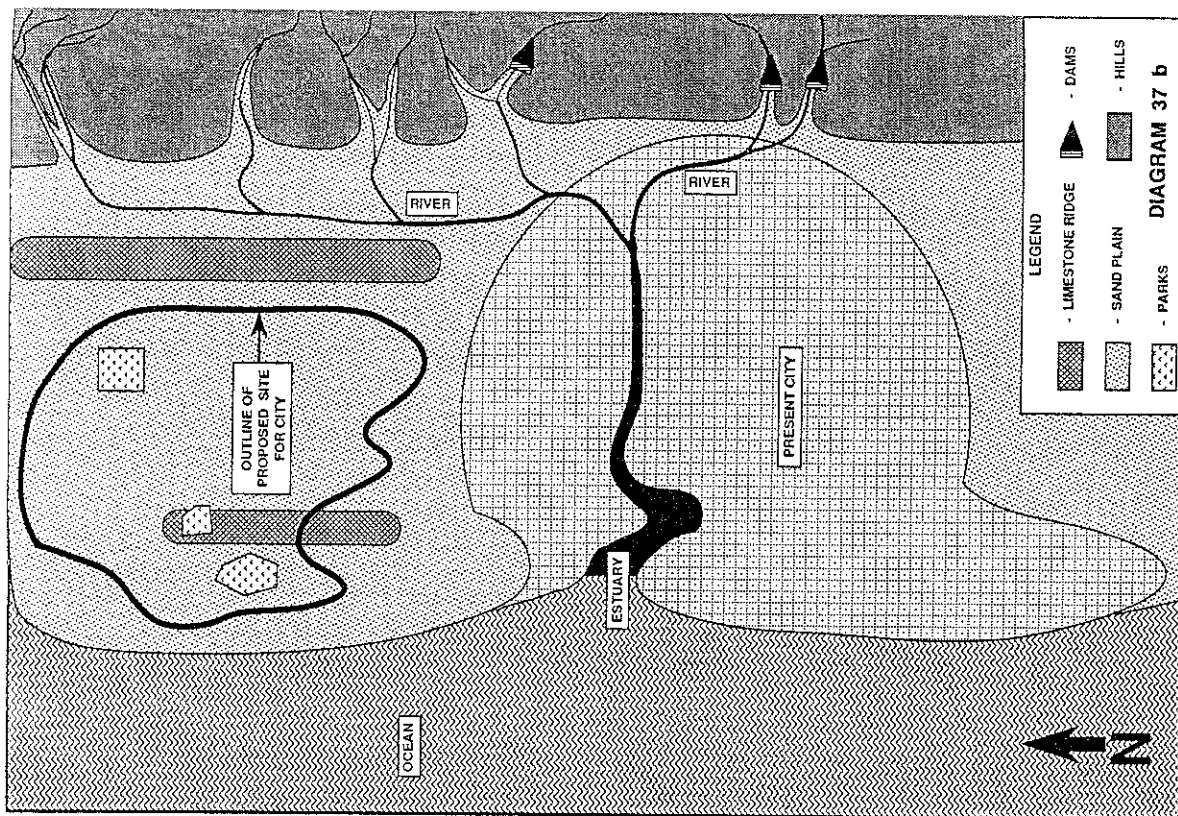
(b) Consider a tract of country near a major city of a million or more persons. The city is situated on a gently undulating coastal plain which is aligned North - South (see DIAGRAM 37b opposite). Shallow water depths occur some distance offshore. The plain comprises deep sands, with a few limestone outcrops on the highest of the low ridges. A large reservoir of fresh water occurs at depths exceeding 20 m below the land surface. A few streams occur on the hills some distance from the city; these are dammed to supply in part the needs for water by the inhabitants of the city.

A diverse biota (array) of sandplain plants and animals inhabit the sand plains, another diverse biota inhabits the low, open woodland on the ridges.

It is planned to build a new city for 250 000 persons north of the city already established.

Predict the possible direct and indirect effects of this increased urbanization on the ecosystems existing in the area. (10 marks)

END OF PAPER



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