

WESTERN AUSTRALIA

TERTIARY ADMISSIONS EXAMINATION,

1976.

Please place one

of your Candidate Identification labels

in this box.

CANDIDATE'S NUMBER:

BIOLOGY

In figures

In words

TIME ALLOWED FOR THIS PAPER:

Reading time before commencing: Ten minutes.

For working paper: Three hours.

MATERIAL TO BE PROVIDED FOR THIS PAPER:

Question paper comprising 41 pages and 46 questions.

One piece of blank paper for rough work.

INSTRUCTIONS TO CANDIDATES: See page 2 of this question paper.

FOR EXAMINER'S USE ONLY							
Section	Question Number	First Mark	Second Mark	Section	Question Number	First Mark	Second Mark
A	1 - 40			C	45 a		
B	41				45 b		
	42				45 c		
	43				46 a		
	44				46 b		
Sub-total B					46 c		
				Sub-total C			

	First Mark	Second Mark
Final Total		

INSTRUCTIONS TO CANDIDATES ARE CONTINUED ON PAGE 2

## INSTRUCTIONS TO CANDIDATES:

Marks will be allocated as follows: SECTION A - 40 marks

SECTION B - 36 marks

SECTION C - 24 marks

Write your number on the front of this question paper.

The answer sheet for Section A is on page 41 which is folded into the back of this paper.

Write your number in the box at the top of page 41 before answering Section A. Attempt ALL questions in this section. Marks are NOT deducted for wrong answers.

When you have completed the Section A answer sheet, fold it back inside the question book. DO NOT tear out this sheet.

Answer Sections B and C in the places provided in the question paper.

You are provided with a piece of blank paper for rough work.

You MUST NOT take this question paper away from the examination room.

SEE PAGE 3

## SECTION A

Suggested time: 60 minutes (40 marks).

Record each answer for questions 1-40 by marking your choice of alternatives on the answer sheet (page 41). For example, if your choice is 3, show it as follows:

1	2	3	4
		X	

An error in recording your choice may be cancelled by completely blocking out the error as shown in 5 above.

Give ONE answer to each of questions 1-40. Marks will not be subtracted for wrong answers.

1. Carbohydrates are commonly found as starch in plant storage organs. Which of the following properties of starch make it useful as a storage material?

1. It is easily identified using iodine solution
2. It is chemically non-reactive
3. It is easily digested by animals which eat the plant
4. It is osmotically inactive
5. It is made during photosynthesis.

2. The liquid which carries dissolved substances such as glucose from a capillary in a muscle to a cell in that muscle is

1. plasma
2. intercellular fluid
3. lymph
4. serum
5. water.

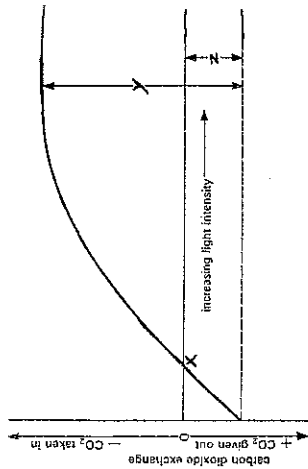
3. The following statement: "... composed of filaments, without chlorophyll, lacking roots and leaves..." best describes:

1. a fungus
2. an alga
3. a clubmoss
4. prothallus of a fern
5. a conifer.

SEE PAGE 4

Questions 4, 5 and 6 are based on the following information.

The graph below shows the effect of light intensity on the exchange of carbon dioxide between a green leaf and the air around it. Note carefully the vertical axis.



4. In terms of carbon dioxide exchange, which statement correctly describes the situation at point X?

1. There is no respiration or photosynthesis occurring.
2. There is a little photosynthesis but no respiration.
3. There is a little respiration but no photosynthesis.
4. The amounts of respiration and photosynthesis are equal.

5. Again in terms of carbon dioxide exchange, consider y and z. The net gain due to photosynthesis may be expressed as

1. y
2.  $y + z$
3.  $y - z$
4. z

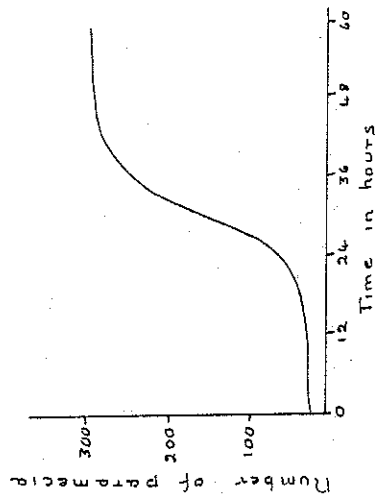
6. Which statement best describes the effect of light intensity on the rate of photosynthesis?

1. The rate increases with increasing light intensity.
2. The rate is directly proportional to light intensity.
3. The rate is inversely proportional to light intensity.
4. The rate increases to a maximum value with increasing light intensity, to a stage where there is no further increase in rate.
5. The rate varies with varying light intensity.

SEE PAGE 5

Questions 7, 8 and 9 are based on the following information.

The graph below shows the results of an experiment to find the rate of population growth in a culture of *Paramecium*. The temperature was kept constant, and the volume of the culture solution was 250 ml.



7. The 12-hour period during which the rate of population increase was greatest was

1. 0 - 12
2. 12 - 24
3. 24 - 36
4. 36 - 48
5. 48 - 60

8. The rapid rate of increase was not maintained. This was NOT due to

1. not enough oxygen
2. lack of room for any more paramecia
3. not enough food
4. death and putrefaction of some paramecia
5. a fall in temperature towards the end of the experiment.

9. In order to estimate the numbers of paramecia the experimenter needed a method which was both accurate and relatively easy to perform. The best method for him to use would have been to

1. count the paramecia in one drop and then find out how many drops make up 250 ml (and multiply by this factor)
2. count all the paramecia in the 250 ml of culture solution
3. count the paramecia in 0.1 ml of solution and then multiply by 2500
4. count the paramecia in ten separate 0.1 ml volumes, obtain an average and then multiply by 2500
5. count the paramecia in the field of view through a microscope and multiply by 250.

SEE PAGE 6

10. The main characteristic of plants classified in the group Tracheophyta is that they

1. have extensive root systems
2. reproduce by seeds
3. have a vascular system
4. are more complex in structure than 'lower plants'.

11. When venous blood pressure is elevated, blood backs up in the capillaries and smallest arteries, thereby raising the blood pressure in these vessels. Thus it is evident that venous pressure changes

1. have slight effect on capillary pressure and tissue fluid volume
2. decrease capillary pressure by causing fluid to move from tissue spaces into the capillaries
3. cause an increase in capillary pressure with a subsequent rapid loss of fluid from the tissue spaces
4. cause an increase in capillary pressure which has little effect on fluid exchange between capillaries and tissue spaces
5. can cause an increase in capillary pressure with the subsequent rapid loss of fluid from the capillaries.

12. Viruses

1. may grow into long threads
2. produce fruiting bodies
3. contain pigments similar to those of algae
4. are unicellular fungi
5. can only multiply in living tissue.

13. In 1886 Adolf Mayer, agricultural chemist for the Dutch Government, noticed some tobacco plants with a pattern of light and dark green areas in their leaves, like a mosaic. Sometimes this condition occurred in areas with poor soil. He could find no sign of bacteria or fungi associated with it. Mayer found that he could transmit the disease if he injected sap from an infected plant into healthy plants.

Which of the following is NOT a reasonable hypothesis according to Mayer's observations?

1. The disease is caused by an organism too small to be seen under the light microscope
2. The disease is caused by a mineral deficiency in the soil
3. The disease is caused by a soluble toxin produced by unseen bacteria in infected plants
4. The disease is caused by an unseen microscopic fungus in the infected plants.

SEE PAGE 7

QUESTIONS 14 AND 15 ARE BASED ON THE FOLLOWING INFORMATION.

Animals not or lose water through the body surface, but also absorb and lose heat through Each animal described in the table below has a body which is roughly cylindrical in shape.

Body measurements	Animal No.				
	1	2	3	4	5
radius cm	0.625	1.25	2.5	5	10
length cm	2.5	5.0	10.0	20	40
volume cm <sup>3</sup>	3.1	24.5	196.0	1560	12600
area cm <sup>2</sup>	11.0	44.4	176.0	718	2814

14. Which animal has the greatest surface area in relation to its volume?

1. Animal 1
2. Animal 2
3. Animal 3
4. Animal 4
5. Animal 5.

15. If all the animals were cold-blooded, which animal's body temperature would change at the slowest rate in relation to the environmental temperature?

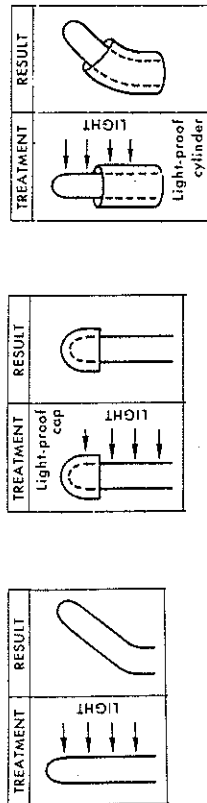
1. Animal 1
2. Animal 2
3. Animal 3
4. Animal 4
5. Animal 5.

16. A hummingbird weighing 3.5 g can fly 800 Km from Florida to central America in 10 hours. In order to carry enough energy reserve for the flight without undue weight, in what form would the energy be best stored?

1. Carbohydrates
2. Proteins
3. Vitamins
4. Minerals
5. Fats.

SEE PAGE 8

17. The figures below show the effects of light on the bending of grass seedlings.

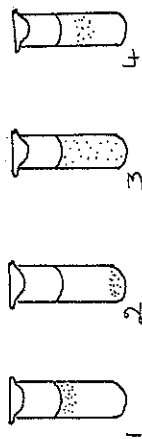


Which of the following best explains these observations?

1. Plants try to get to the light.
2. Light is necessary for photosynthesis.
3. The tip of the seedling detects the stimulus which leads to bending.
4. The base of the seedling detects the stimulus which leads to bending.

Questions 18 and 19 are based on the following information.

The diagram shows the density of bacteria, represented by dark dots, growing in deep agar tubes. The medium is the same in each tube but the bacteria are different species. The colonies are each at their optimum development stage.



18. Which tube contains an organism whose survival is probably independent of oxygen concentration?

1. Tube 1
2. Tube 2
3. Tube 3
4. Tube 4.

19. Which tube contains an organism which is most probably aerobic?

1. Tube 1
2. Tube 2
3. Tube 3
4. Tube 4.

SEE PAGE 9

Questions 20 - 23 are based on what you know about the features of animals and on the following table.

Organism	1	2	3	4	5	6
Order	Marsupalia	Carinatae	Marsupalia	Carnivora	Monotremata	Carnivora
Genus	<i>Thylacinus</i>	<i>Troglodytes</i>	<i>Dasyurops</i>	<i>Felis</i>	<i>Ornithorhynchus</i>	<i>Felis</i>
Species	<i>cynocephalus</i>	<i>trogodytes</i>	<i>maculatus</i>	<i>tigris</i>	<i>anatinus</i>	<i>domesticus</i>
Common Name	Tasmanian tiger	wren (bird)	tiger-cat	tiger	platypus	cat

20. Which two organisms above are most closely related?

1. 1 and 4
2. 1 and 3
3. 2 and 5
4. 4 and 6.

21. Which two organisms above are most distantly related?

1. 2 and 5
2. 5 and 6
3. 1 and 5
4. 5 and 3.

22. Which of the organisms belong to Phylum Chordata?

1. All of them
2. All except 2
3. All except 5
4. All except 2 and 5.

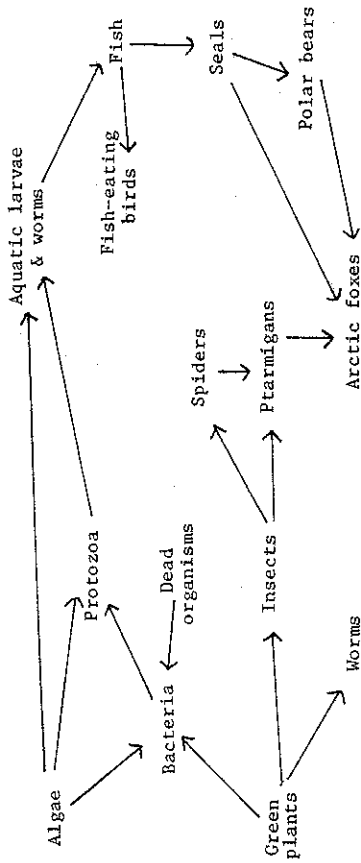
23. Which of the organisms belong to Class Mammalia?

1. All of them
2. All except 2
3. All except 2 and 5
4. 2, 4 and 6 only.

SEE PAGE 10

Questions 24 - 28 are based on the following information.

The relationships of certain organisms of Arctic region are shown below:



24. The series - green plants, insects, ptarmigans, arctic foxes - represents

1. a succession
2. a dynamic equilibrium
3. an energy cycle
4. a food web
5. a food chain.

25. The diagram is an example of

1. an energy cycle
2. a food web
3. an environmental interaction chart
4. an ecosystem.

26. Which of the following statements is NOT true?

1. The arrows in the diagram represent energy flow
2. The number of producer organisms affects the number of polar bears
3. The only first order consumers are insects
4. The largest biomass would be that of the decomposers
5. The diagram shows relationships between populations in different environments.

SEE PAGE 11

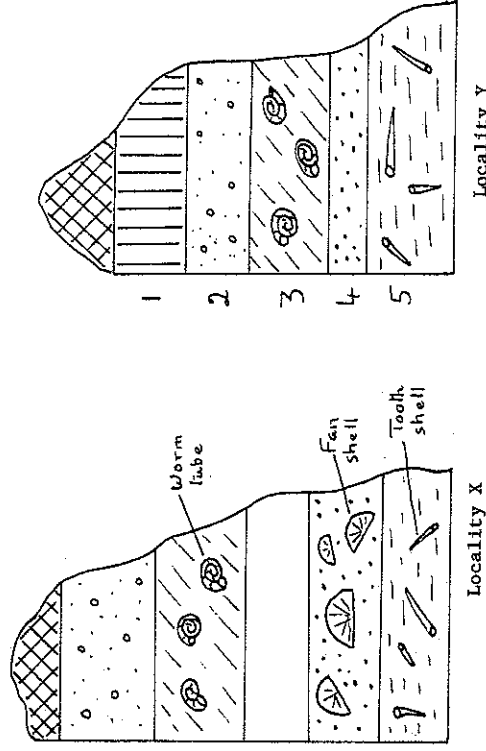
27. Of the following, the organism found in the smallest numbers would most probably be the

1. spiders
2. ptarmigans
3. insects
4. worms
5. green plants.

28. If hunters killed many of the seals in the area, it would be expected that, as a consequence, there would be an increase in the numbers of

1. polar bears
2. arctic foxes
3. fish-eating birds
4. algae.

29. The diagrams below show sequences of rock strata from two different localities. The fan shells are 40 000 years old.



In which stratum at Locality Y would a biologist seek fan shells?

1. Stratum 1
2. Stratum 2
3. Stratum 3
4. Stratum 4
5. Stratum 5.

SEE PAGE 12

32. Which group of organisms represents the most common order of succession of plants in a barren, rocky area?

1. Mosses, grasses, shrubs, then trees
2. Lichens, mosses, grasses, then shrubs
3. Lichens, grasses, shrubs, then mosses
4. Mosses, lichens, grasses, then shrubs.

Spectral colour of sunlight



35. Plant Types A and B were grown under similar conditions in nitrogen deficient soil. Type B produced a healthy crop but Type A produced very straggly plants. From your knowledge of the nutritional requirements of plants, the most probable explanation is that

1. Type B does not need nitrogen for growth
2. Type B can use other minerals in place of nitrogen
3. Type B has nitrogen deficiency
4. Type B can obtain nitrogen from sources other than

4. Type B can obtain nitrogen from sources other than soil.

- SEE PAGE 14

36. It is thought that when hydatid worms first infected dogs, the dogs had little chance of survival. This was bad for the chances of survival of the worm. Eventually, over a very long period of time, the worm no longer killed dogs which then lived to spread the infestation.

This is an example of

1. collaboration
2. adaptation
3. lack of resistance of the dog to infestation
4. diversity.

37. Homeostasis is the biological phenomenon involved in all but one of the following. Which one does NOT involve this?

1. The composition of urine in mammals
2. Sugar concentration in blood plasma
3. The composition of vacuolar fluid in plant cells
4. Feedback mechanisms
5. The maintenance of body temperature in poikilothermic animals.

38. One of Mendel's experiments involved crossing pure-breeding peas having yellow seeds with pure-breeding peas having green seeds. All of the seeds from this cross were yellow. On planting these yellow seeds and allowing the plants to self-fertilize, 6022 yellow seeds and 2001 green seeds were obtained.

Mendel planted some of the yellow seeds and allowed the resulting plants to self-fertilize. What results should have been expected from this experiment if a large number of seeds were produced by each plant?

1. One-third of the plants produced only yellow seeds and two-thirds of the plants produced both yellow and green seeds.
2. One-quarter of the plants produced only yellow seeds and three-quarters of the plants produced both yellow and green seeds.
3. All plants produced yellow seeds.
4. All plants produced green seeds.

SEE PAGE 15

39. Digestion of proteins produces

1. glycerol
2. fatty acids
3. amino acids
4. urea
5. simple sugars.

40. The pupal stage of the life cycle of the house flea lives in floor dust. Fleas tend to stay in this form until they respond to vibrations, whereupon they emerge from their cocoons to feed on blood. With no blood to feed on, the flea soon dies.

A real estate salesman hoping for a sale of a long-vacated house did not want his client to be bothered by fleas when he inspected the house. The simplest solution for the salesman would be to

1. thoroughly clean the dust from the floor of the house
2. have the house fumigated with insecticide
3. run with heavy boots throughout the house a few days before bringing in the client
4. search the house for fleas just before he brings in the client.

Question 41 is on page 16.

SEE PAGE 16

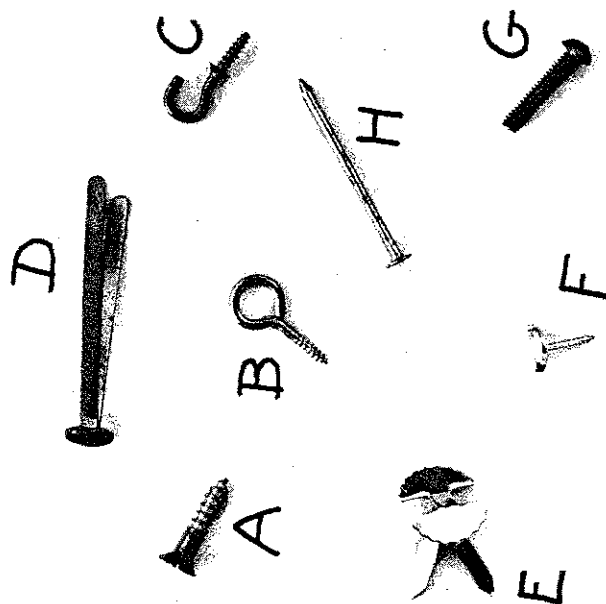


SECTION B

Suggested time: 75 minutes (36 marks).

Attempt ALL the questions in this section. Write your answers in the spaces provided.

41. (7 marks)



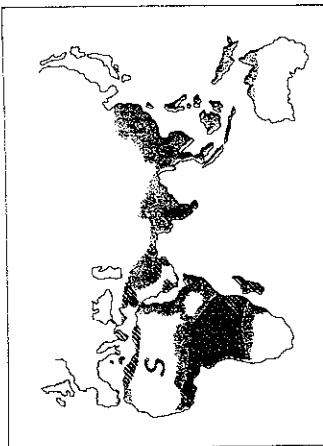
Construct a dichotomous key on the next page which will enable future students to identify the specimens A - H pictured above.

SEE PAGE 17

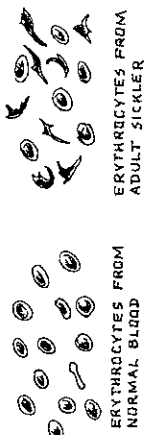
41. (Continued)

SEE PAGE 18

42. (10 marks)



- Distribution of malaria
- Distribution of sickle cell anaemia



In the human condition known as sickle cell anaemia, certain of the red blood corpuscles are changed to an abnormal sickle shape as shown above. Some of these sickle cells are destroyed in the spleen while others tend to clog the capillaries. The consequent reduction in numbers of oxygen-carrying cells has an adverse effect on the individual. The disease is genetically controlled and causes early death in the homozygous condition.

The map shows the distribution of malaria and the areas in which there is a high incidence of sickle-cell anaemia in the human population.

The Table shows the result of an investigation into the incidence of malaria and sickle-cell anaemia in a sample of 290 people in Central Africa.

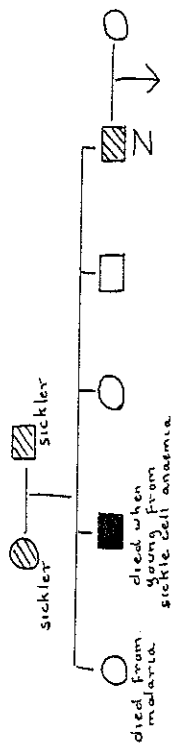
	With malaria	Without malaria	Total
Sicklers	28%	72%	100%
Non-sicklers	46%	54%	100%

SEE PAGE 19

42. (Conti. d)

(a) What is the vector of malaria?

(b) How would you account for the absence of malaria in the Sahara Desert (marked S on the map)?



(c) From the above family tree

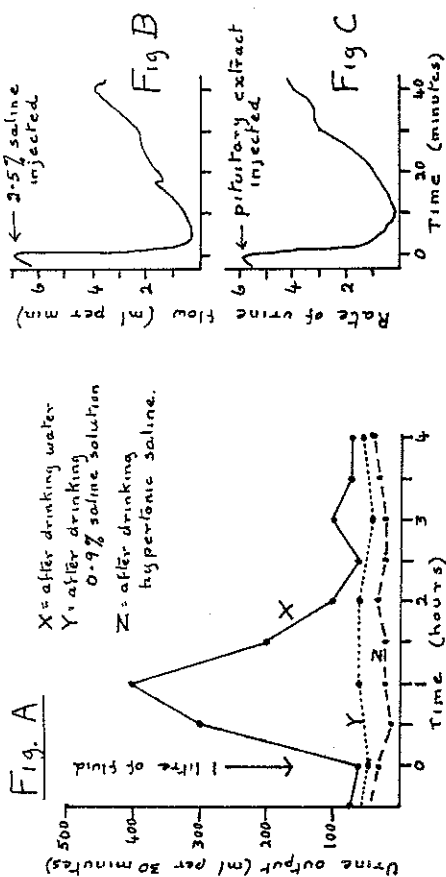
- (i) state the genotype and phenotype of the female who died from malaria:  
genotype \_\_\_\_\_ phenotype \_\_\_\_\_
- (ii) what is the probability that any child of Z will die from sickle cell anaemia?

(iii) what is the probability that a child of Z will be a sickler and also a male?

(d) What explanation can you offer for the retention of the sickle-cell gene in the human population of Central Africa?

SEE PAGE 20

43. (10 marks)



(a) How long did it take for the dog to eliminate as urine all of the water it had drunk?

Figure A also shows the result of drinking one litre of 0.9% saline which has the same osmotic concentration as blood plasma.

(b) What effect did drinking this liquid have on urine production during the next four hours?

(c) What happened to the litre of saline over this period?

(d) What do the results of this second experiment indicate about the effect of the volume of blood plasma on kidney function? Explain.

SEE PAGE 21

43. (Continued)

(e) What does a comparison of the results of the two experiments indicate about the effect of the osmotic pressure of the blood plasma on kidney function? Explain.

To determine the location of the region sensitive to changes in plasma osmotic concentration, 10 ml of a solution of 2.5% NaCl was injected into a large vein in the dog's neck. No immediate change in urine flow was noticed. However when a similar injection was made into a neck artery, the result was as shown in Fig. B.

(f) In view of these results, what statement can you make about the location of the sensor which detects changes in plasma osmotic concentration?

In a final experiment a pituitary gland extract from another dog was injected into the neck vein of the experimental animal and the effect was as shown in Fig. C.

(g) In view of these data, what type of substance is likely to control the rate of urine output from the kidney? Explain.

SEE PAGE 22

44. (9 marks)

While searching through some old files a biologist found the following piece of a hand-written scientific report

APPARATUS:

RESULTS:

DISTRIBUTION OF FLIES AFTER 30 MINUTES

TRIALS	VIAL		
	A	B	C
1	13	12	15
2	20	5	4
3	12	15	14
4	7	29	2
5	30	19	25
TOTALS	82	80	60

OBSERVATIONS:

It is interesting to note that in this experiment was seen that the fruit flies were attracted to the light.

SEE PAGE 23

44. (Continued)

(b) Identify three variables which were being controlled.

(c) Name three possible uncontrolled variables.

(d) How could the design of the experiment be improved? Explain.

(e) What do the results indicate? Explain.

SEE PAGE 24

## SECTION C

Suggested time: 45 minutes. Each question is worth 12 marks. Answer BOTH questions.

Write your answers on the sheets provided at the end of this section.

45. EITHER (a)

(i) What is meant by adaptation to environment?

(ii) Explain why adaptation is important by describing an example of each of

structural

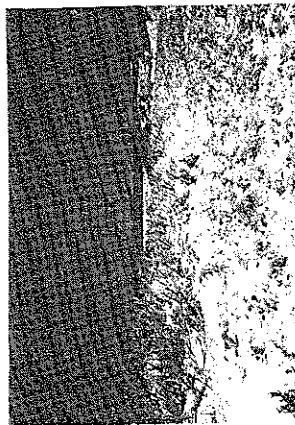
physiological

reproductive and

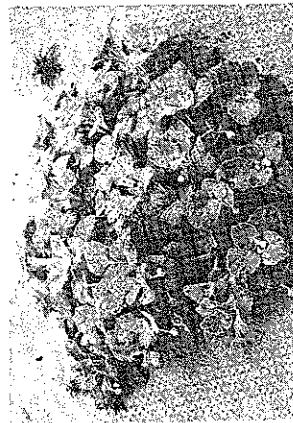
behavioural adaptation

using a range of animal examples.

(iii) Study the three illustrations of *Arctotheca populifolia* and, using your knowledge of plant adaptations, explain how it is adapted to its environment in terms of its appearance and structure.



*Arctotheca* in its normal environment.



A plant of *Arctotheca populifolia*.



A leaf of *Arctotheca populifolia*.

SEE PAGE 25

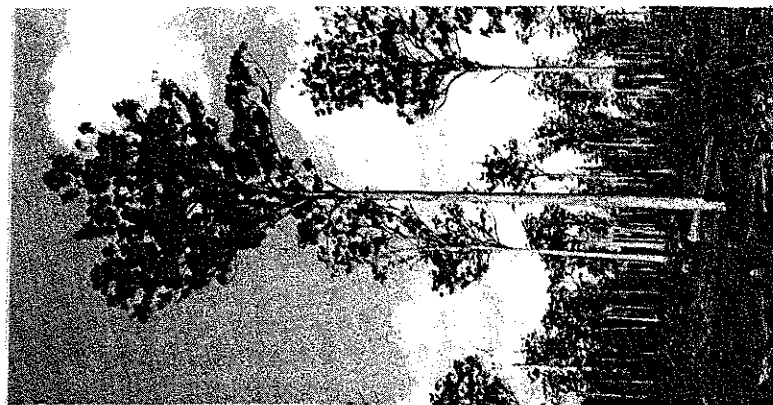
45. (Continued)

OR (b)

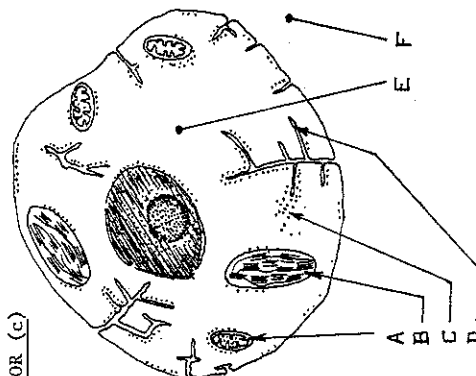
A study of the structure of most land plants shows that they have specialised transport systems.

In the forests of the south-west of Western Australia some trees are over a hundred metres high.

Explain the processes involved in transporting water in such tall trees from the soil to the topmost leaves and eventually out through the stomatal pores.



OR (c)



(i) Identify and explain the function of each of the organelles A, B, C and D in the diagram of a plant cell.

(ii) Explain the different ways by which materials are exchanged between the areas marked E and F in the diagram.

SEE PAGE 26

46. EITHER (a)

It has been proposed to establish a woodchip industry in the south-west of Western Australia. Arguments for and against this plan have been put forward by foresters, conservationists and others. The decision on the extent to which the industry should be allowed to develop must be based on a sound knowledge of the ecology of the area. Many such decisions have to be made in different parts of the world today.

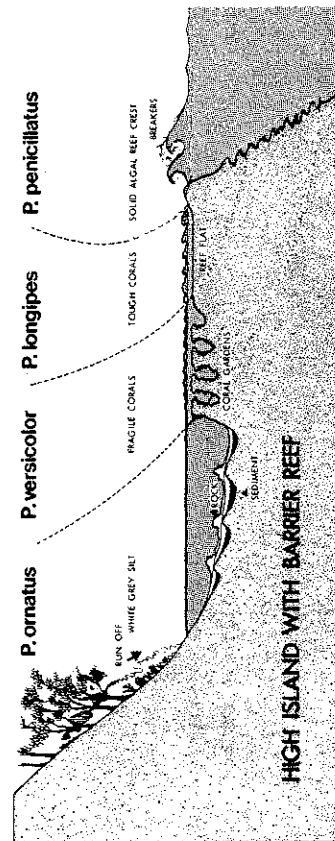
Discuss the relationship (i) between the living organisms and (ii) between the living and non-living components of the environment that need to be investigated to gain an understanding of the ecology of an area.

OR (b)

Coral reefs often grow in situations which are sheltered on one side by a land mass but their outer edge faces the open sea. Reefs are therefore susceptible to the influence of both the land and the surrounding ocean.

Rock lobsters of the genus *Paralichius* inhabit barrier reefs and might be expected to be uniformly distributed throughout such an area. However the research results summarised in the diagram below indicate that the reef provides habitats for four species of *Paralichius*.

Suggest reasons for the distribution as shown and relate these to the survival of each of the species.



SEE PAGE 27

46. (Continued)

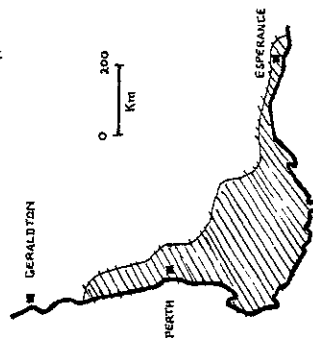
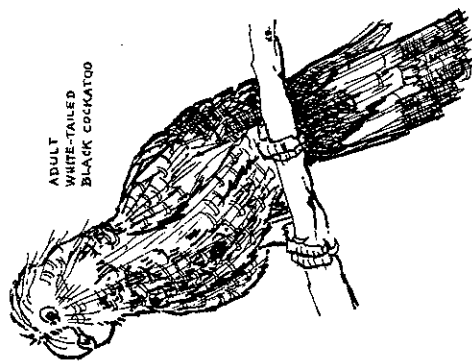
OR (c)

Mr. Denis Saunders of the Division of Wildlife Research is studying the white-tailed black cockatoo and has been able to split the single species into two sub-species based on the beak length.

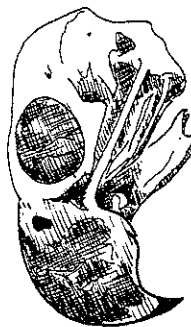
The two sub-species prefer different food. The long-billed birds favour marri seeds most, but when this food is scarce these cockatoos can become a pest in apple and pear orchards. The short-billed birds seek out pine seeds, but will also eat banksia and hakea seeds.

- (i) Why is diversity within a species important?
- (ii) What factors can cause diversity within a population?
- (iii) Of what importance is isolation in causing speciation within an originally diverse population? Include in your answer the operation of three isolating mechanisms.

(iv) From the information provided, why do you think that the two sub-species are able to co-exist throughout the same geographical range?



DISTRIBUTION OF BOTH LONG AND SHORT BILLED COCKATOOS



SKULL OF SHORT BILLED COCKATOO



SKULL OF LONG BILLED COCKATOO

END OF PAPER