

BIOLOGY

Please place one of your Candidate
Identification labels in this box

CANDIDATE'S NUMBER - In figures

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In words

TIME ALLOWED FOR THIS PAPER

Reading time before commencing: Ten minutes
For working of paper: Three hours

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

See Page 2

FOR EXAMINER'S USE ONLY					
Section	Qu. No.	1st mark	2nd mark	Qu. No.	1st mark 2nd mark
A	1-40			47a	
	41			47b	
B	42			47c	
	43			48a	
	44			48b	
	45			48c	
	46				
Sub Total B				Sub Total C	

Total	1st mark =	2nd mark =	Final Total =
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MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

TO BE PROVIDED BY THE SUPERVISOR

This Question/Answer Booklet comprising 47 pages and 48 questions
One piece of blank paper for rough work
A Separate Multiple Choice Answer Sheet

TO BE PROVIDED BY THE CANDIDATE

Standard Items

Pens, pencils, eraser, ruler

Special Items

An 'HB' 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 non-personal nature in the examination room. Please check carefully and, if you have any unauthorised material with you, hand it to the supervisor BEFORE reading any further.

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/ANSWER BOOKLET.

Attempt all questions in Section A on the Separate Multiple Choice Answer Sheet, which will be collected separately by the Supervisor.

Use an 'HB' PENCIL. DO NOT use a ball point or ink pen.

Marks are not deducted for wrong answers.

Answer Sections B and C in the places provided in the question paper. Draw graphs in pencil before inking in the lines.

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

DO NOT copy the question when writing an essay (Section C). Merely write the number of the question in the margin.

Use a blue or black PEN (not pencil) when answering Sections B and C.

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

SEE PAGE 3

SECTION A

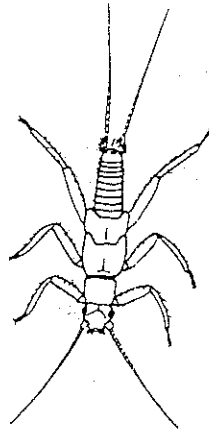
Suggested time: 60 minutes (40 marks)

Record each answer for questions 1-40 by marking your choice of alternatives on the Separate Multiple Choice Answer Sheet using an 'HB' pencil.

If you want to change an answer, rub out your first answer and mark your new one.

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

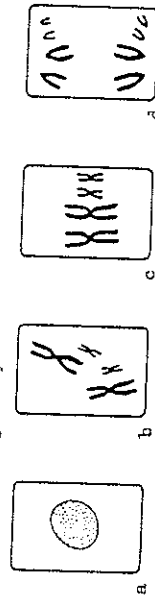
1. The following diagram is of an insect larva collected from a freshwater stream.



The general appearance of the animal suggests that it is mainly found

- A. walking on the surface of the water
- B. swimming in a quietly flowing pool
- C. clinging to stones on the bottom of the stream
- D. burrowing in the mud or ooze at the bottom of a pool

2. The diagrams below represent stages of cell division as they would occur in a developing embryo.



The stage during which the quantity of DNA doubles is that labelled

- A. a
- B. b
- C. c
- D. d

SEE PAGE 4

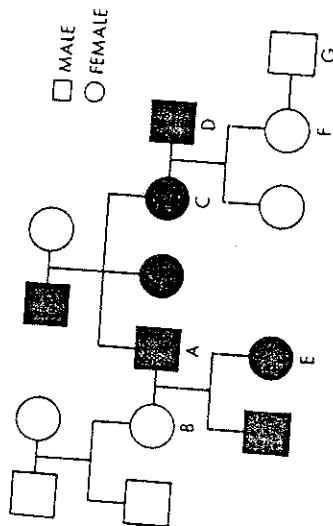
BIOLOGY

3. If an orange tree stock is grafted on to a branch of a lemon tree, then the tree is likely to bear

A. lemon-orange hybrids
B. oranges and lemons
C. lemons only
D. oranges only

Questions 4, 5, 6 are based on the following guinea pig pedigree.

Guinea pigs with black coats are shown in black, while white-coated guinea pigs are represented by white.



4. According to this pedigree, black coat colour in guinea pigs appears to be produced by

A. a dominant gene
B. a recessive gene
C. an incompletely dominant gene
D. spontaneous mutation

5. The probability of guinea pigs A and B producing a white offspring could be expected to be

A. 0
B. $1/4$
C. $1/2$
D. 1

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6. It can be inferred that offspring F received a gene for

A. black from each parent
B. white from each parent
C. black from its male parent and the allele for white from its female parent
D. white from its male parent and the allele for black from its female parent

7. Antarctic penguins are much larger than penguins living in more temperate regions. A satisfying explanation of this would most likely invoke which one of the following factors?

A. Breeding seasons are short in Antarctica; hence penguins there lay fewer and larger eggs than penguins in warmer latitudes
B. The fishes on which penguins feed are larger in cold water than in warmer water
C. Cold air contains a larger percentage of oxygen than warm air
D. Small bodies have a larger surface-to-volume ratio than large bodies

8. In order to determine the fate of carbon atoms in a plant, one of its leaves was enclosed in a plastic bag containing air in which the carbon atoms of the CO_2 had been replaced by radio-active carbon atoms (^{14}C). Tests would have shown that, on being absorbed into the leaf, the labelled carbon atoms were

A. used in the manufacture of sugar and stored as such in the leaf
B. used in respiration and passed out in CO_2
C. incorporated into sucrose and transported in the phloem
D. immediately made into starch and transported in the phloem

9. A population of 2000 birds had the following statistics during one year: 100 births, 10 immigrants, 50 deaths, 20 emigrants.

The rate of population increase was

A. 40 birds/year
B. 20 birds/year
C. 20 birds/2000/year
D. 20 birds/1000/year

SEE PAGE 6

10. Which of the following requires no expenditure of metabolic energy?

- A. Passage of a nerve impulse across a synapse
- B. Synthesis of thyroxine
- C. Diffusion of sodium chloride through blood plasma
- D. Passage of a nerve impulse along an axon

11. In 1889 two German physiologists, von Mering and Minkowski, removed the pancreas from some dogs in an attempt to investigate its function. One seemingly trivial observation was that ants were attracted in large numbers to the kennels in which the dogs with no pancreas were kept, but not to the kennels of normal dogs.

Which of the following responses best explains how this information gave the physiologists a valuable clue as to pancreatic function?

- A. The ants were attracted to digestive enzymes which passed out with the faeces
- B. The ants were attracted to sugar in the urine of the dogs
- C. The ants knew that the dogs were dying
- D. The ants sought waste products in the urine which were normally removed by the pancreas

12. Which of the following is an example of the nervous and chemical co-ordinating systems working together?

- A. Increasing the CO_2 concentration in the blood stimulates the breathing centre which, in turn, sends impulses to the breathing muscles to increase the rate of respiration
- B. The presence of excess glucose in the blood causes an increase in the production of insulin which, in turn, regulates the blood sugar level
- C. A piece of sour food placed on the tongue causes the production of saliva by the salivary glands
- D. If a chemical, such as an acid, is placed on the skin, pain receptors send impulses to the central nervous system

13. The robin redbreast was once called *Erithacus rubecula* and considered to be in the family of warblers (Sylviidae). Since that time this genus has been transferred to the family of thrushes (Turdidae). The name of this bird should now be

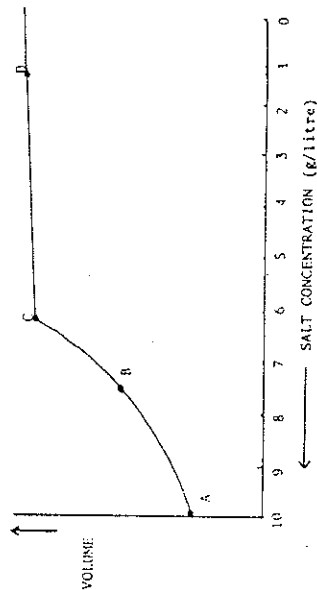
- A. *Turdus rubecula*
- B. *Erithacus rubecula*
- C. *Turdus erythrura*
- D. *Sylvius erithacea*

SEE PAGE 7

Question 14 is based on the following information.

A scientist wished to find out the approximate salt concentration in the cells of a certain plant. He placed some of this plant material in a number of solutions of different salt concentration and measured the volume of a single cell from each plant sample.

The following results were obtained.



14. Which of the points A to D indicates the normal salt concentration within the cell?

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

15. Which of the following statements about sensory receptors in vertebrate skin is INCORRECT?

- A. All skin receptors are connected to sensory neurones
- B. All skin receptors are connected directly to motor nerves which carry messages to the brain
- C. Messages from these receptors may trigger reflex actions, via motor nerves, before reaching the brain
- D. The centres of feeling, which interpret the impulses from these receptors, are all in the brain

16. It is sometimes said that "a good hot cup of tea will help to cool you down". The basis of this belief is that

- A. tea contains a substance which stimulates the temperature control mechanism in the brain
- B. the stimulus of food in the stomach draws warm blood away from the skin surface
- C. the additional heat in the body stimulates the production of sweat, thus assisting the cooling process
- D. tea stimulates heart function, thus causing a more rapid circulation of blood around the body

SEE PAGE 8

17. Which of the following statements about fossil formation is most acceptable?

- A. Most of the organisms that populated the earth in past ages have been preserved as fossils
- B. A large proportion of the fossils that have been produced in past ages has been recovered by scientists
- C. While fossils may reveal some of the anatomical features of animals, they do not give any indication of the animals' habits
- D. Only very few creatures die under conditions that make their preservation possible

18.

Slime moulds are fungus-like organisms which commonly grow on the surface of decaying plant matter. Each consists of a flowing mass of protoplasm containing many nuclei which are not separated from each other by cell walls. Under suitable conditions the mass of protoplasm grows upwards into a stalk capped by a capsule in which many hard-walled resistant spores are formed. If they land on suitable material, the spores germinate and then combine with each other to form the protoplasmic 'plasmodium'.

Which features of this group of organisms could be regarded as typically animal-like?

- A. Reproducing by spores and lack of a cell wall
- B. Reproducing by spores and lacking chlorophyll
- C. Ability to move about because of a lack of cell wall
- D. Lacking chlorophyll and ability to move about

19.

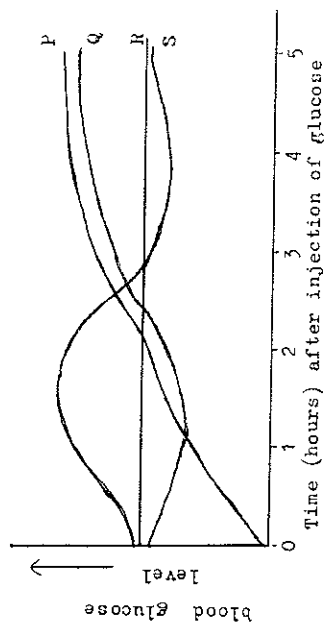
An attempt to grow large numbers of a bacterium, *Escherichia coli*, on a medium containing streptomycin resulted in the death of most of the organisms. Each of the few colonies which survived on the medium grew from a single individual bacterium. A cell taken from one of these colonies succeeded in growing on the streptomycin-containing medium, demonstrating that a resistant strain had been obtained.

If streptomycin was usually lethal to *E. coli*, some of the bacteria on the first plate survived because

- A. they were able to produce antibiotics
- B. having come into contact with only a small amount of streptomycin, they built up an immunity
- C. they did not actually come into contact with the streptomycin
- D. they possessed a natural immunity to streptomycin

SEE PAGE 9

Question 20 is based on the diagram below.



20. The glucose level of blood taken from an artery in the arm of a mammal was measured each hour for five hours after the animal had ingested glucose. Which of the curves P to S shows blood glucose levels in a healthy mammal?

- A. Curve P
- B. Curve Q
- C. Curve R
- D. Curve S

21.

Nestling wrens are brown in colour except when they open their mouths. Then the bright yellow lining shows up. It is suggested that this bright colour is a stimulus which directs the parent birds to put food into the mouth of the nestling. Which of the following experiments might test this hypothesis?

- A. Model nestlings, some with yellow mouths and others with brown mouths, were placed in the nest
- B. A nestling of a different species with greenish feathers was introduced into the nest
- C. More food was provided to the parent birds for feeding the nestling
- D. Two extra nestlings were introduced into the nest

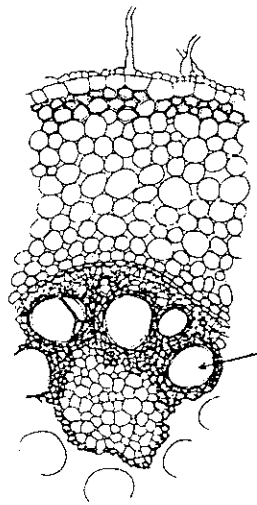
22.

In hermaphrodite species, sperms from one individual usually unite only with the eggs of another individual. In this case hermaphroditism can be an advantage because it

- A. means that both individuals produce offspring
- B. increases the chance of finding a mate
- C. both increases the chance of mating and the number of individuals producing offspring
- D. means that the organism can produce offspring when only one sex is present

SEE PAGE 10

23. Rabbits in the laboratory are able to breed throughout the year and can have up to seven litters annually. However, studies of the wild rabbit in South Australia show that no more than five litters a year are produced, usually in winter and summer months. The most likely reason for this is that
- the climate of South Australia is totally unlike that to which they were originally adapted
 - rabbits need not produce more than five litters in order to maintain their numbers
 - the protein content of grasses varies during the year
 - in the wild, the number of young produced tends to be approximately equal to the number killed by predators
24. If living cells, similar to most of those found on earth, were found on another planet on which there was no free oxygen, which of the following organelles would be unlikely to be present?
- Mitochondria
 - Chloroplasts
 - Endoplasmic reticulum
 - Ribosomes
25. The diagram below represents the cross section of part of a plant.



The function of the structure indicated by the arrow is to

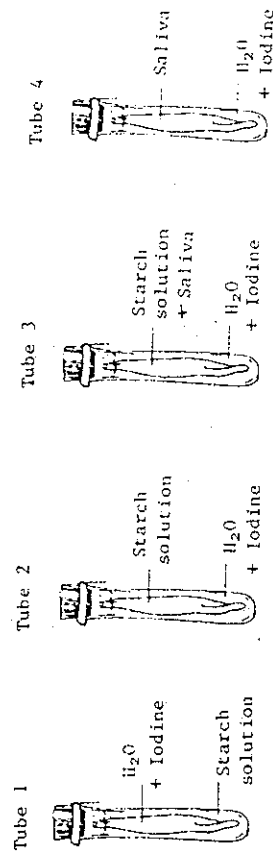
- stiffen the shoot and not to transport materials
- transport water and sugars from shoots to roots
- transport water and mineral salts from shoots to roots
- transport water and mineral salts from roots to shoots

SEE PAGE 11

26. The physical nature of protoplasm is best described as a
- jelly-like substance in which are dissolved proteins, fats and carbohydrates
 - mixture of several solutions containing salts, proteins and carbohydrates
 - complex system of salts, fats, carbohydrates, enzymes, proteins and vitamins
 - watery substance containing small amounts of enzymes, fats, carbohydrates and salts

Questions 27 and 28 are based on the following information.

Four test tubes were set up, each containing a suspended bag made of dialysis tubing. The constitution of the fluid in each bag and of that around it is indicated in the diagram.



27. In which tube will the contents of the dialysis tube turn black?

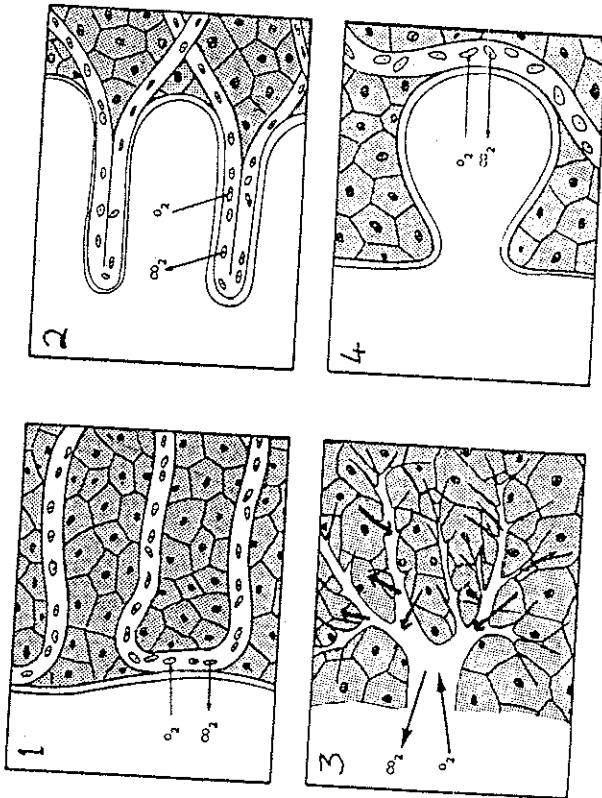
- Tube 1
- Tube 2
- Tube 4
- Both Tube 2 and Tube 3

28. If the solution outside the bag in each tube was tested with Fehling's or Benedict's solution, or with Testape, in which tube would you expect to find a reaction?

- Tube 1
- Tube 2
- Tube 3
- Tube 4

SEE PAGE 12

Question 29 is based on the following diagrams which represent four types of surface over which exchange of gases takes place.



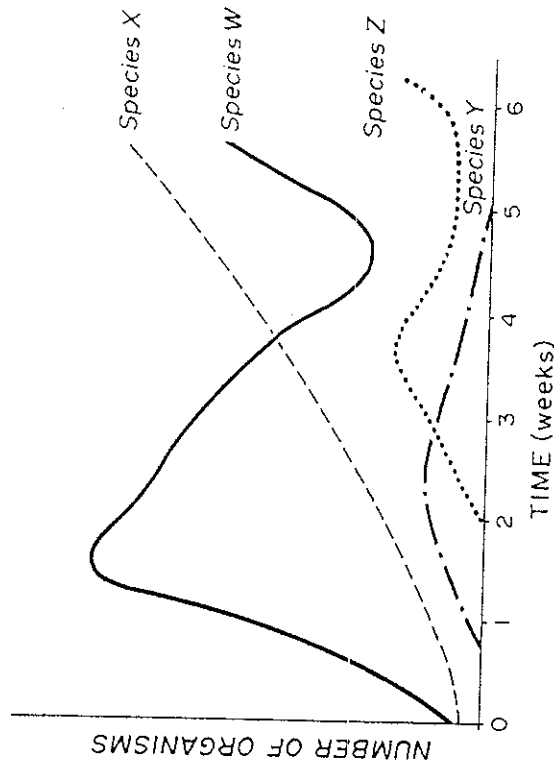
29. Which group of animals is most likely to have the surfaces indicated?

	Surface Type			
	1	2	3	4
A. Group A	Snake	Cat	Emu	Tadpole
B. Group B	Amoeba	Crayfish	Grasshopper	Elephant
C. Group C	Earthworm	Yabbie	Rabbit	Dolphin
D. Group D	Skin of frog	Goldfish	Ant	Magpie

SEE PAGE 13

Questions 30 and 31 are based on the following information.

The contents of a flask (comprising $\frac{1}{2}$ litre of water, mineral nutrients and wheat grains) were boiled. The flask was plugged with cotton wool and the contents allowed to cool. A pinch of soil was added to the contents and the flask was placed on a window ledge. At regular intervals, representative samples were taken and a count was made of the four species of organism present (W, X, Y and Z). The graph indicates the relative size of the populations of W, X, Y and Z over a period of six weeks.



30. Of the following, the best interpretation of the data is that

- A. species Z is probably a producer
- B. species Z is probably a consumer
- C. species Z is probably a predator
- D. there is insufficient information to make a judgement such as A or B or C.

31. Organisms present in a simple system such as this

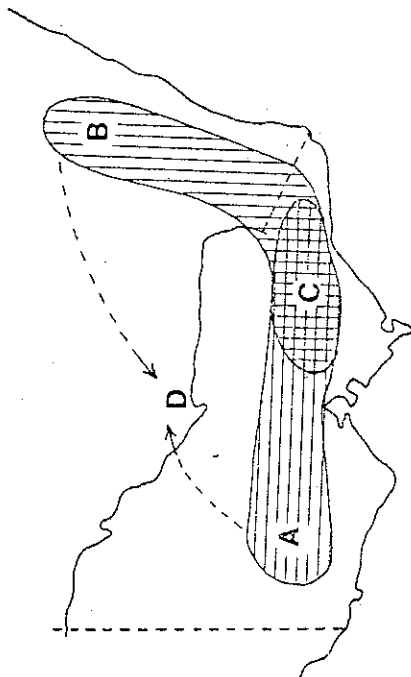
- A. change their environment in such a way that other organisms can take advantage of it
- B. have no real effect on the environmental conditions
- C. fluctuate in numbers as the generations live and die
- D. have a very short life span and therefore appear and disappear quickly

SEE PAGE 14

32.

During the breeding season a male frog produces a mating call which is characteristic of its species. A female of the same species responds to this call by moving to the male, apparently ignoring the calls of males of other species that may be present in its vicinity.

A zoologist studying the distribution of brown tree frogs in southeastern Australia finds that there are two structurally similar, but still recognizably distinct, forms of the frog. The two forms have overlapping distributions as shown in the map below.



One of the two forms occurs alone in area A, the other occurs alone in area B. Both forms occur in area C. Mating calls of males taken from area A are similar to mating calls of males taken from area B, but in area C the two forms have distinctly different mating calls.

The zoologist makes crosses between the two forms from all parts of their ranges and finds that hybrids are produced, but they are sterile. On the basis of this information which of the following statements CANNOT be supported?

- There are two distinct but closely related species present, which are likely to have evolved from an immediate common ancestor
- The two forms were originally geographically isolated and when they came together in area C, the differences in mating call structure resulted from the action of natural selection
- If the present distributions in areas A and B were to expand so that the two forms met again in area D (see map), although hybrids may be produced, the parental populations would still maintain their distinctness
- If the two forms were able to produce well-adapted and fertile hybrids, then the call differences in area C could still have arisen through natural selection

SEE PAGE 15

Question 33 is based on the following information.

A lizard was placed in a heated trough until its body reached a steady temperature. It was then transferred to a ventilated container at a different temperature. The time was recorded for its temperature to fall to within 3° of the container temperature. This procedure was repeated several times with the same lizard at a number of different temperatures.

The results are shown below:

Experiment	Trough temperature ($^{\circ}\text{C}$)	Lizard temperature ($^{\circ}\text{C}$)	Container temperature ($^{\circ}\text{C}$)	Lizard's lower temperature ($^{\circ}\text{C}$)	Time for temperature change (min.)
W	30	32	10	13	20
X	40	42	15	18	35
Y	50	52	10	13	20
Z	60	62	15	18	25

33. Which experiment shows the most rapid rate of heat loss?

- Experiment W
- Experiment X
- Experiment Y
- Experiment Z

34.

Cockroaches 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.

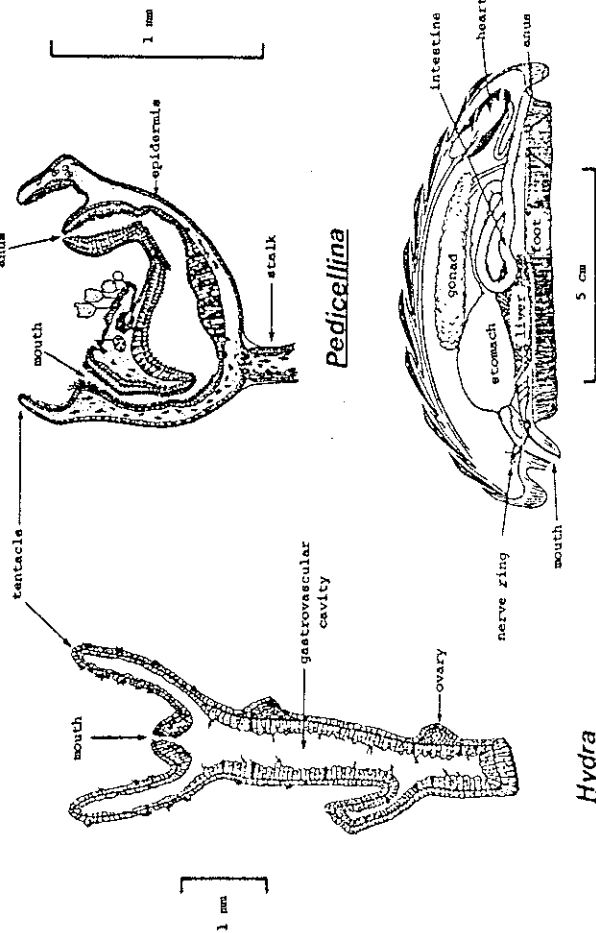
A cockroach which had lost its rhythmic activity was surgically attached to one having rhythmic activity so that their bloods mingled. The pair was then placed in continuous light and both animals showed the rhythmic activity pattern.

It would be reasonable to say that

- 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

SEE PAGE 16

Question 35 is based on the diagrams below.



35. In the digestive tracts of multicellular organisms there may be specialized sections which allow the sequential digestion and absorption of food.

Which of the above organisms have this type of specialization?

- A. *Chilton* only
- B. All three
- C. *Pedicellina* and *Chilton* but not *Hydra*
- D. *Pedicellina* and *Hydra* only

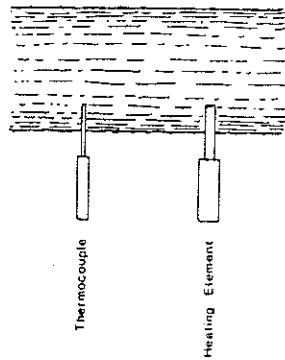
36. If a small part of an embryo animal is removed, the space will often close over so that no evidence of the wound remains. However, if a similar part is removed at a later stage it never regrows and that part will be missing from the fully formed animal.

This is best explained by:

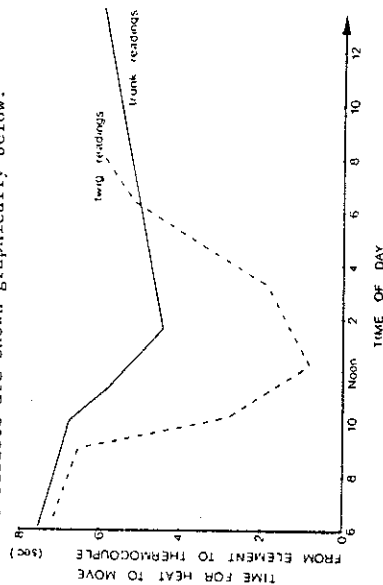
- A. the removal of so many cells causes much damage
- B. the cells remaining in the late embryo have differentiated and cannot change their structure to fill the gap
- C. cells are predetermined in the early embryo to form a particular structure
- D. replacement cells cannot move from one place to another in the late embryo

SEE PAGE 17

Question 37 is based on the following information. A plant physiologist investigating the movement of fluids in trees performed the following experiment. He placed a small electric heating element in the xylem of a tree. A few inches above this he inserted a thermocouple (a temperature-sensitive device) into the xylem. The arrangement is shown in the diagram below:



He allowed the element to heat for a few seconds, switched it off, then on again, and so on. The thermocouple recorded passing waves of heat. He used the difference between the time when the element was heated and the time the temperature rise was noted on the thermocouple, to estimate the rate of movement of the fluid in xylem. He repeated the procedure many times during the course of a clear, warm, sunny day, on both the trunk and twigs of a tree. Each time he recorded the time taken for the heat to move from element to thermocouple. His results are shown graphically below.

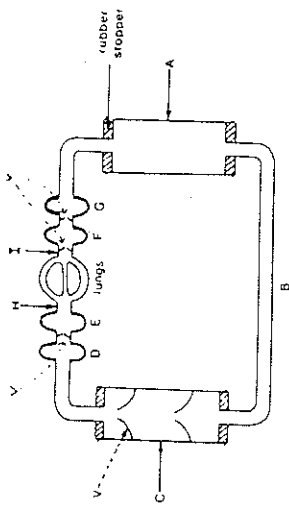


37. Which of the following generalizations about water movement in plants is supported by these results?

- A. Water in plant stems is pulled up from the crown rather than pushed up from the roots
- B. The column of water in the xylem is under tension when the plant is transpiring
- C. The speed of water movement in plants is affected by the environmental temperature
- D. The stomatal opening through the middle of the day is greater than early in the morning or at night

SEE PAGE 18

Questions 38 and 39 are based on the following information. A biology student was asked to construct a simple working model of a mammalian circulatory system, using materials that were available to him in the school laboratory. A diagram of his apparatus is shown below:



The model was constructed entirely of glass tubing and rubber stoppers, except for structures D, E, F, and G, which are rubber bulbs, and the structures labelled V which are rubber flaps designed to act as one-way valves. The "lungs" are represented, as shown, by a series of three glass tubes. Before sealing, the apparatus was filled with water containing a red dye, to represent the blood. The model is operated by squeezing the rubber bulbs in sequence.

38. In this model

- A. structure A represents the aorta and arteries which lead from it
- B. structure C represents the heart
- C. structure I represents the pulmonary artery
- D. structure E represents the right atrium of the heart

39. To make the model represent the circulatory system more accurately, which of the following changes could be made?

- A. replace the "lungs" with a coiled length of plastic tubing
- B. replace container C with a piece of flexible rubber tubing
- C. replace tube B with a meshwork of interweaving fine capillary tubes
- D. replace the four rubber bulbs with small electric pumps that would maintain the "blood flow" at a constant pressure

40. One winter seven sailors were shipwrecked on a barren Antarctic island which had water, but neither soil nor vegetation. A crate of cornflakes and one containing seven hens were cast ashore with them. In order to survive as long as possible, the sailors should have

- A. fed the cornflakes to the hens as long as they lasted and then eaten the hens
- B. killed and eaten the hens and then eaten the cornflakes
- C. fed the cornflakes to the hens and eaten the eggs which the hens produced
- D. eaten the cornflakes, giving none to the hens, and then eaten the hens when they died of starvation

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SECTION B

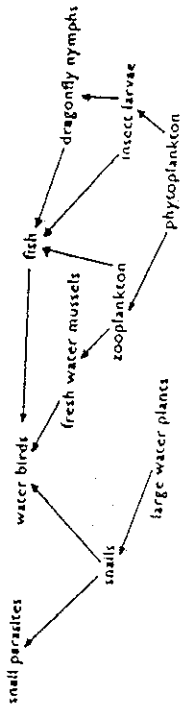
Suggested time: 75 minutes (36 marks)

Attempt all questions in each section.

Write your answers in the spaces provided.

41. (8 marks)

Illustrated below is a food web for a fresh water pond.



(a) i. What are the producers in the pond?

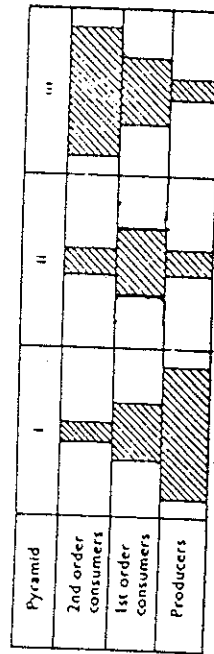
Where do they get their energy?

ii. Write down the longest food chain in the food web.

(b) Which essential groups of organisms are not included in this food web diagram?

What function do they have in a food web?

(c) Illustrated below are three "Pyramids of Numbers" which could apply to some of the food chains of the food web.



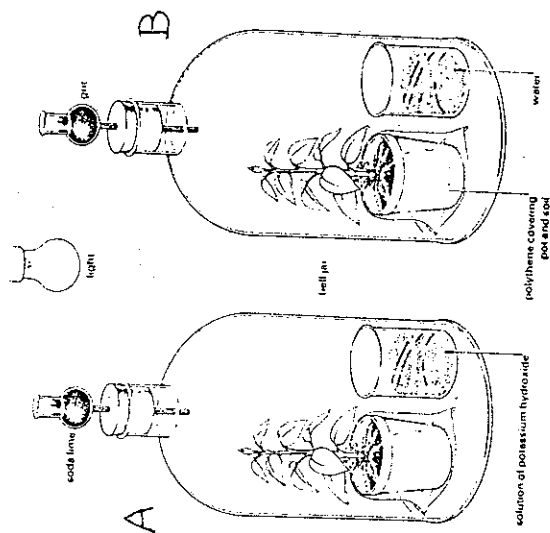
Write the names of organisms in the spaces provided which are appropriate for the "pyramids" i, ii and iii.

(i) _____ (ii) _____ (iii) _____

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42. (6 marks)

The following diagram shows the apparatus used to demonstrate one aspect of photosynthesis. Soda lime was used as a CO_2 absorber.



After three days the investigators tested leaves from both plants by boiling them in water, decolorizing them in alcohol, and placing them in a solution of iodine in potassium iodide. Leaves from plant B turned black and leaves from A turned light brown.

(a) What is the hypothesis on which this experiment is based?

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42. (continued)

(b) Explain the role of:

the polythene bag

the potassium hydroxide

the water

the light

(c) How was the experiment controlled?

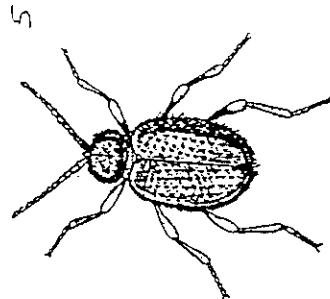
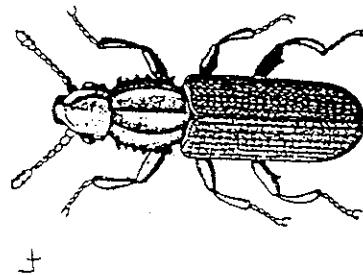
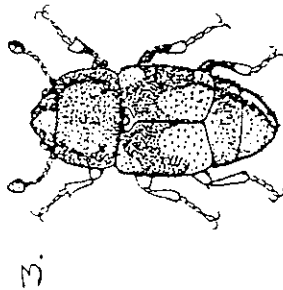
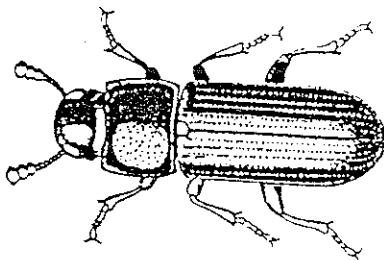
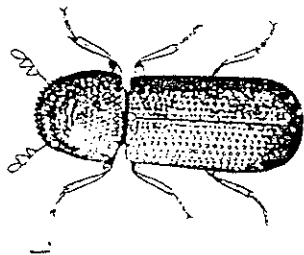
(d) Under what conditions should the experimental plants be kept before starting the experiment to ensure valid results?

(e) What features in a plant would make it ideal for this experiment?

SEE PAGE 22

43. (4 marks)

Construct a dichotomous key which will permit the examiner to identify each of the five insect species below.



SEE PAGE 23

43. (continued)

SEE PAGE 24

44. (6 marks)

Dwarfs are found among mice as in many other species. Dwarf mice are sterile and arise from certain lines of apparently normal mice. The table shows weight increases of twelve mice born from normal parents.

Age in days	Weight of mice (grams)											
	A	B	C	D	E	F	G	H	I	J	K	L
6	3.9	3.7	3.7	3.7	3.0	3.3	2.9	3.5	3.3	3.7	3.6	3.3
8	5.3	5.0	4.8	4.8	4.8	4.4	3.8	4.8	4.8	4.9	4.8	4.5
13	7.4	7.3	7.3	6.9	6.5	6.8	4.4	7.0	6.5	6.5	6.5	6.4
15	8.0	8.6	8.0	7.7	7.2	7.3	4.6	7.4	6.3	7.2	7.2	7.9
19	9.3	9.9	9.0	9.1	9.2	8.0	4.8	8.1	6.6	8.5	8.9	8.8
22	10.7	11.4	11.0	11.5	10.5	10.2	4.2	10.1	6.1	9.8	10.5	8.5
26	15.7	15.5	15.9	15.5	15.7	13.0	4.5	14.8	6.2	12.7	15.0	12.1
28	-	-	-	-	-	-	4.9	-	6.2	-	-	-
29	19.1	18.5	20.3	18.4	18.9	15.7	5.2	17.8	6.7	14.7	17.3	14.7
33	-	-	-	-	-	-	5.0	-	6.4	-	-	-
34	23.8	23.5	26.1	24.8	24.4	20.6	-	20.7	-	17.0	21.0	17.5
36	25.7	24.3	27.6	25.5	26.1	22.2	5.9	21.8	7.2	18.5	21.6	18.4
39	27.9	26.4	27.9	28.1	29.4	24.1	5.0	24.2	6.5	20.3	23.0	20.0
42	28.7	27.4	28.8	28.4	28.8	24.7	6.8	24.3	7.7	19.9	23.4	20.3
46	28.9	27.6	29.4	27.7	28.4	25.8	6.6	25.5	6.4	19.8	23.5	19.8

Note: A dash indicates no measurement taken.

(a) Graph the data for mouse A and mouse G. Use the graph paper on page 25.

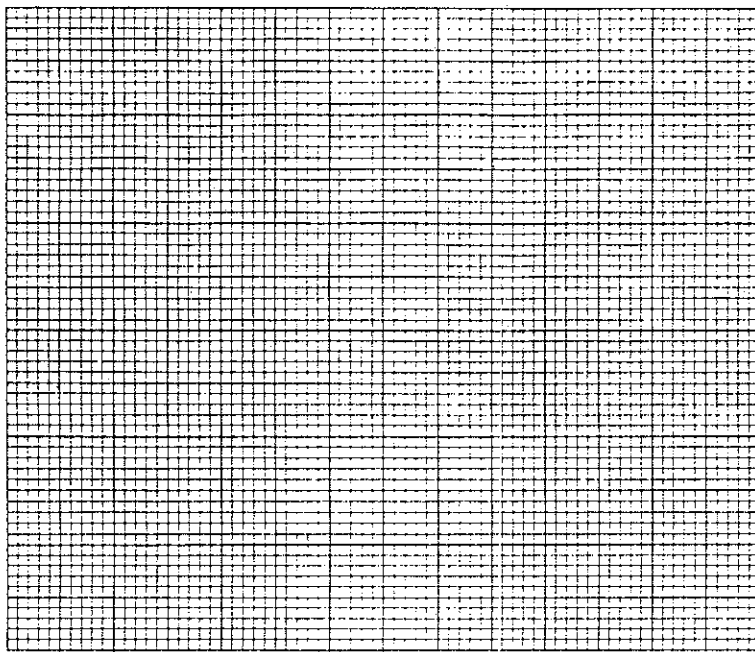
On the twenty-second day the normal mice were separated from their mothers while the dwarf mice remained with their mothers until the thirty-sixth day before being separated.

(b) Compare the influence of maternal care on the development of the two young mice A and G.

SEE PAGE 25

SEE PAGE 26

44. (continued) The spare graph on page 47 may be used if you spoil this one.



(c) When could the effects of the dwarfing gene be first detected as influencing the pattern of growth?

(d) Which would be the better criterion to use for determining the developmental progress of the mice - weight or tail length? Explain your answer.

45. (6 marks)

The comparative rarity of our native fauna is often blamed on agricultural clearing and destruction of the natural habitat. However, a study of fauna in undisturbed forest in the south-west of Western Australia showed that even in this region the numbers of medium-sized marsupials are decreasing. The following data were obtained in this study.

Fig. 1: Spotlight Sightings of Three Species along a 3.2 km Route in the Northern Perup Fauna Priority Area

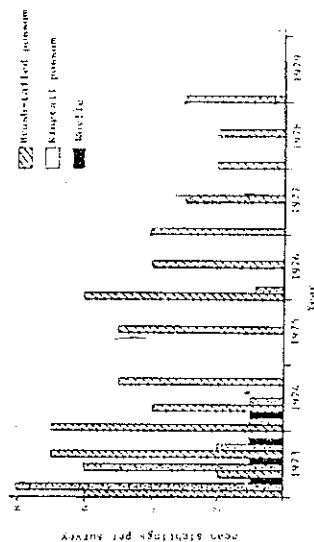


Table 1: Mortality of Native Marsupials in a 3-year Study of the Perup Area

	Probable Cause of Death			
	European Fox	Native Cat	Wedge-tail Eagle	
Woylie	15	7	1	
Tammar	7	-	5	

Table 2: Rabbit Poisoning Programme and Spotlight Sightings of Foxes during a 10-year Period

	No. of Baits Laid for Rabbits in the South West	Average No. of Foxes Sighted in Spotlight	
		Cape Naturaliste	Chidlow
1968	8066	-	-
1969	6800	-	-
1970	4900	-	-
1971	5500	-	-
1972	4600	-	-
1973	2600	-	2.4
1974	700	4.9	17.2
1975	50	5.1	19.2
1976	93	5.7	31.1
1977	-	3.8	37.1
1978	-	8.2	34.9

SEE PAGE 27

45. (continued)

(a) Suggest an explanation for the relationship given in Table 2.

(b) What interpretation is suggested by the information in Figure 1 and Table 1?

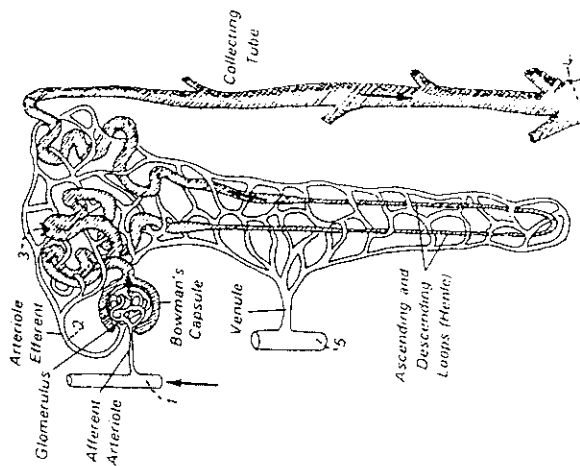
(c) In view of your answer to (a) suggest two reasons why a poisoning programme in one small area of the South-West using 1080 to kill foxes has shown little sign of success.

(d) Native marsupials survive better in areas where the undergrowth is dense and where poisonous native pea plants grow. Suggest two reasons for their greater survival.

SEE PAGE 28

46. (6 marks)

The diagram below is of a nephron from a kidney of a mammal.



Samples of blood were taken at the points labelled 1, 2 and 5 and of the fluid within the tubule at points 3 and 4. The following table shows the constituents of these samples (in mg/100ml of fluid) and the volume of fluid passing points 1, 3, 4 and 5 in 24 hours.

Dissolved Substances	1	2	3	4	5
	Arterial Blood	Post- Glomerular Blood	Glomerular Filtrate	Urine	Venous Blood
Protein	6750.0	7900.0	0.0	0.0	6767.0
Glucose	120.0	120.0	120.0	0.0	118.0
Urea	30.0	30.0	30.0	2000.0	25.0
Other Nitrogenous Wastes	4.0	4.0	4.0	280.0	33.0
Volume of Fluid per 24 hours	800 litres	not measured	160 litres	1.5 litres	798.5 litres

SEE PAGE 29

46. (continued)

(a) What substance(s) pass(es) from the blood into the glomerular filtrate? (Note the concentration of the arterial blood, post-glomerular blood and glomerular filtrate.)

(b) Since no protein is broken down or produced in the kidney, how do you explain the increase of 1150mg/100ml in the post-glomerular blood?

(c) Why has the protein figure of venous blood returned almost to the arterial blood level?

(d) Explain what happens to the glucose in the glomerular filtrate.

(e) What probably happened to the water content of the glomerular filtrate?

(f) Explain why the urea in the urine is so concentrated.

SEE PAGE 30

SECTION C

Suggested time: 45 minutes (24 marks)

There are three alternatives to each question. Choose ONE alternative from each question.

Each question is worth 12 marks. Answer both questions in essay form.

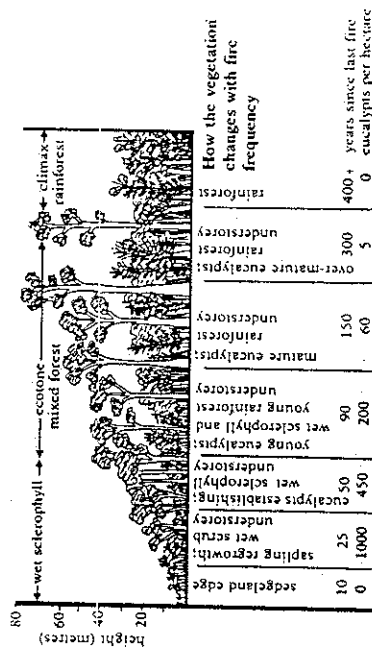
Write your answers on the sheets provided at the end of this section.

Where possible, support your answers with labelled diagrams.

47. EITHER

(a) Tasmanians are the custodians of most of this country's temperate rainforest, which covers some 7% of their island. The western half of the state is cool and wet, conditions which are highly suitable for rainforest growth, and yet we find a mosaic of vegetation - rainforest, eucalyptus forest, scrub and sedgeland.

The Relation between Fire Frequency and Vegetation Type
in the Wetter Regions of Tasmania



Research programmes in recent years have provided evidence for this reduced distribution of rainforest.

The fire history of one district in southern Tasmania was recorded in the growth rings of the white waratah. Some scrub and button grass areas had experienced four fires in a 40-year period. Other signs indicated that the mixed forest in the area had not been burned for 250 years, while the rainforest had not experienced fire for more than 300 years. In two cases a burn had spread from scrub into mixed forest; in one of these places, fire had not recurred and the forest was regenerating; in the other case, a fire had recurred six years later and button grass had invaded the area. In nearby areas, remains of rainforest trees were found among the button grass.

SEE PAGE 31

47. (a) (continued)

In the north-east of Tasmania, in the fertile highlands, it was found that rainforest once covered a much larger area than the restricted patches found there today. Aborigines reputedly set fire to the area in the distant past, but when Europeans evicted the Aborigines, fire was not used so often. At this time the eucalypt stands began to increase. Later, dieback disease began to appear in rainforest at high elevations (about 1000 m), and now rainforest extends down to about 800 m.

As an experiment, four plots were marked off containing a range of vegetation from that with no dieback to that severely affected with the disease. Each quarter of a plot was treated in one of four ways:

- (1) No treatment
- (2) Understorey felled
- (3) Understorey felled and burnt once
- (4) Understorey felled and burnt three times

Felling and burning the understorey led to a 60-70% improvement in the growth of dieback-affected trees. The most frequently burnt plot had its rainforest virtually eliminated and grass cover appeared, changing the understorey from one associated with dieback to one normally accompanying healthy growth. If a rainforest understorey developed, the average temperature of the soil around the eucalypt roots was found to be 3-5°C cooler which is equivalent to an altitude increase of about 500 m.

(i) Summarize the factors which seem to result in:

- (a) death of the eucalypts
- (b) death of the rainforest
- (c) spread of dieback

(ii) How does burning of the forest understorey result in a growth increase of eucalypts?

(iii) What benefits would the Aborigines have gained by burning the forests?

(iv) What procedures could forest officers use to maintain a successful eucalypt regrowth?

(v) What benefits could derive from a healthy rainforest ecosystem that could not be obtained from a eucalypt ecosystem?

SEE PAGE 32

47. (continued)

OR

(b)

"Increased understanding of the interactions within ecosystems, both natural and agricultural, improves human capacities to manage and conserve them."

At intervals the Department of Fisheries and Wildlife issues regulations governing the fish catches which may be made by amateur fishermen. Some of the most recent changes are shown in the table below.

Table of Amateur Fishing Bag Limits

Effective before and after February 22, 1985

Species	Catch limit for one day	
	Before 1985	1985
Abalone (<i>Haliotis conicopora</i>)	10	5
Abalone (<i>Haliotis roei</i>)	36	20
Blue Manna Crabs (<i>Portunus pelagicus</i>)	36	24
Mussels (Family Mytilidae)	no limit	20 litres
Rock Lobsters (all species)	8 (per licensed amateur)	16 (per boat)
Southern Bluefin Tuna (<i>Thunnus maccoyii</i>)	no limit	5

Each year the Department of Fisheries and Wildlife sets the limits of the duck shooting season. In some years no shooting is permitted at all. In other years the season may be a three-week period near Christmas time, or even longer.

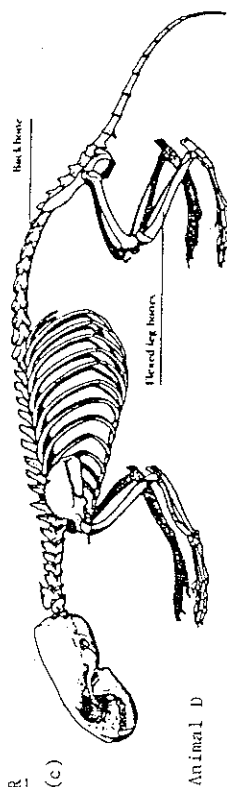
Discuss the factors which the Department would have to consider in order to determine the limits which must be set for the capture of wildlife.

SEE PAGE 33

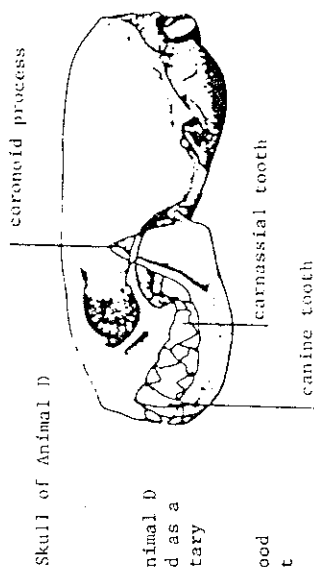
47. (continued)

OR

(c)



Animal D



Skull of Animal D

The fossilized skeleton of Animal D pictured above was discovered as a complete specimen in sedimentary rocks.

- (i) Suggest what kind of food Animal D ate and how it obtained its food.

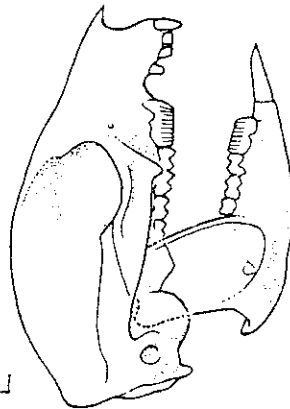
In each case support your suggestions with the relevant information from the skeleton.

- (ii) Together with Animal D were found several other skulls, three of which are shown below. All skulls are drawn to the same scale, including the skull of Animal D.

Explain all of the possible inter-relationships there may have been between Animal D and organisms E, F and G.



F



E



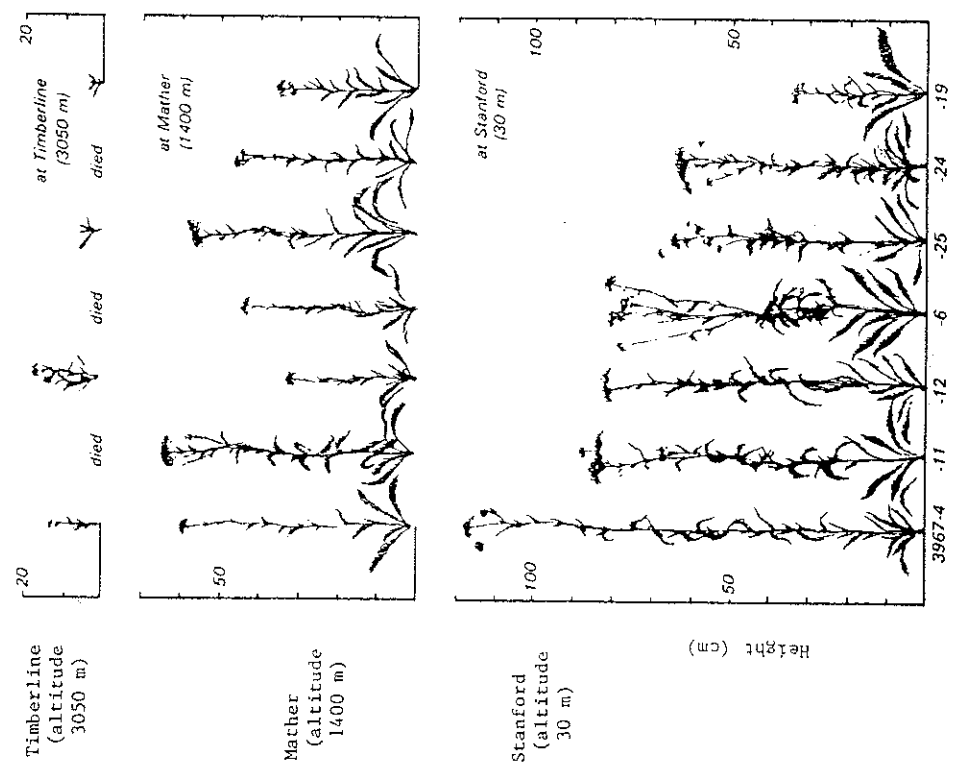
G

SEE PAGE 34

48. EITHER

(a)

Figure 1: Responses of clones of 7 yarrow plants of the Groveland population when grown at Stanford, Mather and Timberline.

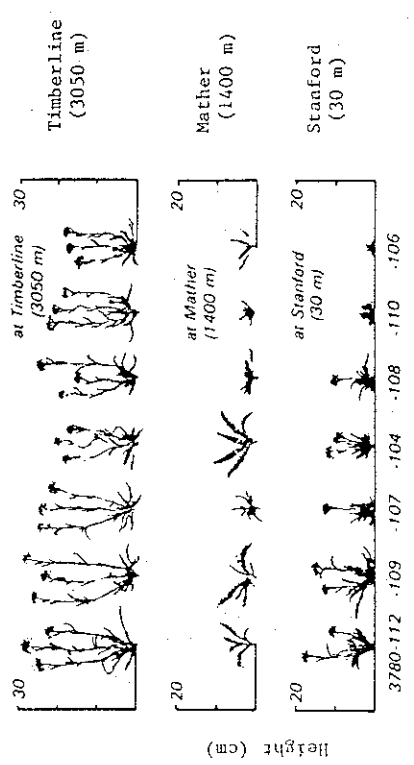


Identification numbers of original Groveland plants

SEE PAGE 35

48. (a) (continued)

Figure 2: Responses of clones of 7 yarrow plants of the Bighorn Lake population when grown at Stanford, Mather and Timberline.



Identification numbers of original Bighorn Lake plants

In California, yarrow plants grow throughout the Sierra Nevada range from near sea level through to sites at more than 3600 metres. Seven plants were collected from Groveland at 915 m and seven from Bighorn Lake at 3350 m. Each of these plants was multiplied, by propagating cuttings, into three genetically identical plants (clones). The seven sets of plants from each location were then planted at three different altitudes.

The results are shown in Figures 1 and 2.

- (i) Suggest what may have caused the variation in growth size amongst the Groveland plants planted at Stanford.
- (ii) What may have caused the variation in growth size among the clones of any one plant at the three different altitudes?
- (iii) The Bighorn Lake plants responded quite differently from those from Groveland to conditions at the three plots. Suggest how this difference could arise.

SEE PAGE 36

48. (continued)

OR (b)

Figure 1. Productivity of the oceans.



Figure 3. Variation of nitrate concentrations (measured in micrograms of nitrogen per litre) with depth.

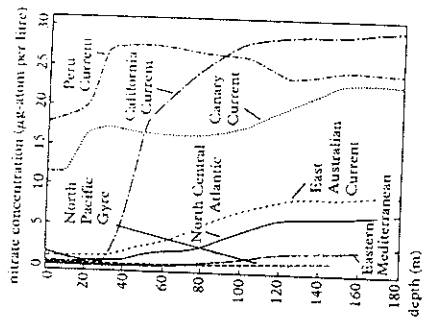
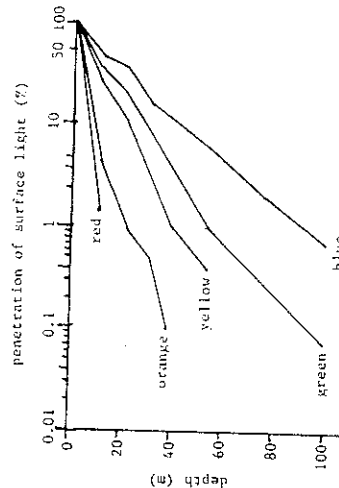


Figure 2. Depth of penetration into the sea of light of different wavelengths.



SEE PAGE 37

48. (b) (continued)

Table 1. Algae in marine phytoplankton and their major light-harvesting pigments.

	Chlorophylls			Accessory pigments
	a	b	c	
blue-green algae	+			phycocyanin
red algae	+			phycoerythrin
dinoflagellates	+		+	peridinin
golden-brown algae	+		+	fucoxanthin
diatoms	+		+	fucoxanthin
green algae	+	+		siphonaxanthin

Table 2. Pigments as population indicators.

	0	20	40	60	80	100	120	140	150
chlorophyll a									
chlorophyll c									
carotene									
fucoxanthin									
chlorophyll b									
lutein									
peridinin									

Table 3. Part of the light spectrum chiefly absorbed by photosynthetic pigments.

chlorophyll a	blue, red
chlorophyll b	blue, orange
chlorophyll c	blue
carotenes	blue, blue-green
fucoxanthin	blue, blue-green
phycoerythrin	green, yellow
phycocyanin	orange

The tropical rainforests of the world are often considered to be the world's most productive plant ecosystems. Yet they pale by comparison with the unicellular phytoplankton of the oceans.

Whereas 90% of the world's chlorophyll in terrestrial plants fixes 64% of the world's carbon by photosynthesis, the 7% chlorophyll in unicellular marine plants fixes as much as 32% of the world's carbon. Marine plant chlorophyll therefore appears to be six times more effective than terrestrial chlorophyll in fixing carbon.

Research shows that phytoplankton grown in blue-green light produced 20-500% more chlorophyll a and c than phytoplankton grown in white light. Blue-green light also increased photosynthetic carbon fixation and reduced chlorophyll degradation.

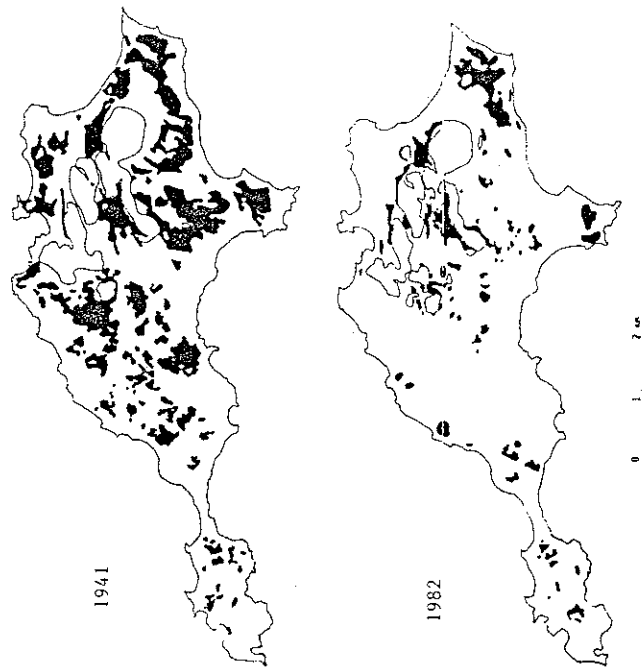
From the information given in Figures 1 to 3 and Tables 1 to 3 and from your own knowledge of plants, discuss the possible reasons for the difference in photosynthetic efficiency between tropical rainforests and phytoplankton.

SEE PAGE 38

48. (continued)

OR (c)

Figure 1. Maps showing the distribution of Low Forest or Scrub vegetation cover on Rottnest Island in 1941 and 1982. (After Pen and Green 1983, J. Roy. Soc. W.A. 66, 23, reproduced with permission.)



Prior to 1920 the quokka population on Rottnest Island lived in relatively stable equilibrium with the *Acacia* scrub which covered at least two-thirds of the island. The rest of the island was covered with prickly bush, *Acanthocarpus preissii*, and tussock grass, *Stipa variabilis*. However, in the late 1920s quokkas were declared protected which led to a sudden increase in their numbers in the early 1930s. In recent months it has been suggested that quokka numbers should be controlled by fencing them out of popular tourist locations or perhaps by poisoning them.

Discuss

- (i) the problems which an ever-increasing quokka population could present to the island.
- (ii) possible means whereby quokka numbers might be controlled, giving the advantages and disadvantages of each method.
- (iii) possible reasons for the change in vegetation distribution seen in Fig. 1.

END OF PAPER