WESTERN AUSTRALIA

TERTIARY ADMISSIONS EXAMINATION

1983

BIOLOGY

Please place one of your Candidate Identification labels in this box

CANDIDATE'S NUMBER:

In figures | | | | | | |

In words _____

TIME ALLOWED FOR THIS PAPER:

Reading time before commencing: Ten minutes

For working paper: Three hours

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER:

TO BE PROVIDED BY THE SUPERVISOR

Question paper comprising 35 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, rubbers, ruler

Special Items

A "B" or "2B" pencil for the separate Multiple Choice Answer Sheet

NOTE: No other items may be taken into the examination room

FOR EXAMINER'S USE ONLY

Section	Qu. No.	1st mark	2nd mark	Section	Qu. No.	1st mark	2nd mark
A	1-40			C	46a		
B	41				46b		
	42				46c		
	43				47a		
	44				47b		
	45				47c		
Sub Total B				Sub Total C			

Total	1st mark =	2nd 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.

Attempt all questions in Section A on the separate Multiple Choice answer sheet, which will be collected separately by the Supervisor.

USE a "B" or "2B" 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.

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 a "B" or "2B" 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.

Questions 1 and 2 are based on the following information:

An animal was found living in a cold freshwater stream. It had a smooth shiny, grey-brown body about 30cm long. It possessed a powerful flat tail, a short flat head with red external gills and four weak legs with toes but no toenails. It had a dorsal nerve cord, a skull and vertebrae. The organism ate crayfish, fish eggs and other water animals.

1. This organism is most likely to be
   1. a fish
   2. a reptile
   3. an amphibian
   4. an invertebrate

2. One clue to this organism's phylum is its
   1. notochord
   2. four legs
   3. slimy body
   4. external gills

3. Guard cells are specialised epidermal cells occurring in plants. They are distinguished by the fact that they
   1. occur only on the leaves of plants
   2. do not contain chloroplasts
   3. have cell walls of unequal thickness
   4. are always associated with epidermal hairs

SEE PAGE 4

4. In a greenhouse, young corn plants are grown under optimal conditions of soil, temperature, light and humidity. Which of the following procedures would increase the rate of photosynthesis?

   1. Adding magnesium to the soil
   2. Adding ATP and magnesium to the soil
   3. Increasing the O_2 content of the atmosphere
   4. Increasing the CO_2 content of the atmosphere

5. Below a depth of about 200 metres plants do not grow in the ocean. They can, however, live above this level. Which of the following factors is responsible for preventing plant growth in depths below 200 metres?

   1. A lack of CO_2
   2. A lack of O_2
   3. A lack of mineral nutrients
   4. A lack of light of the proper wave length

6. Which of the following statements BEST describes the relationship between photosynthesis and respiration?

   1. Photosynthesis and respiration are reverse chemical processes
   2. Energy is stored during photosynthesis and released during respiration
   3. Photosynthesis takes place during the day and respiration during the night
   4. Photosynthesis is a function of plants and respiration is a function of animals

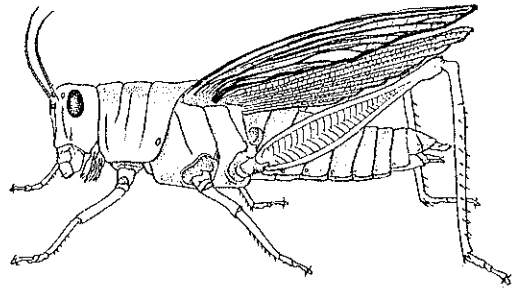
7. One important difference between salt and fresh water as a living place for organisms is

   1. salt water is more buoyant than fresh water
   2. the salt concentration affects the flow of water into, or out of, the organism
   3. the dissolved oxygen concentration is altered by the salt
   4. salt water is usually colder than fresh water

SEE PAGE 5

Questions 8 and 9 are based on the following key:

1. a) Wings present 2
   b) Wings absent ..... Order Apterygota
2. a) With one pair of wings ..... Order Diptera
   b) With two pairs of wings 3
3. a) Front wings of coarser texture than hind wings 4
   b) All wings membraneous. May be hair or scale covered 8
4. a) Basal two-thirds of front wing thickened, remainder membraneous ..... Order Hemiptera
   b) Whole of front wing of same texture 5
5. a) Front wings hard and horny ..... Order Coleoptera
   b) Front wings slightly thickened with distinct veins 6
6. a) Mouthparts of piercing type ..... Order Hemiptera
   b) Mouthparts of biting type 7
7. a) Hind legs much longer than other legs ..... Order Orthoptera
   b) All legs more or less equal in length ..... Order Blattodea
8. a) Wings and body completely covered by fine scales or hairs ..... Order Lepidoptera
   b) Wings without scales or hairs 9
9. a) Hind and front wings linked by a row of hooks. Front of abdomen narrowed to form a 'waist' .... Order Hymenoptera
   b) Wings not joined. No 'waist' ..... Order Odonata



8. According to the key, the order to which the above insect belongs is

   1. Diptera
   2. Odonata
   3. Hemiptera
   4. Orthoptera

9. Lepidoptera would have the following characteristics

   1. two pairs of membraneous wings covered in fine scales
   2. one pair of membraneous wings lacking scales or hairs
   3. two pairs of wings, the front pair being of coarse texture
   4. two pairs of membraneous wings which are not hooked together and lack hairs or scales

SEE PAGE 6

Question 10 is based on the following information:

Common name	Scientific name
Cougar	Felis concolor
Timber wolf	Canis lupus
Tasmanian wolf	Thylacinus cynocephalus
Tiger	Panthera tigris
Native tiger cat	Dasyurus maculatus
Domestic cat	Felis catus

10. Which two animals in the above list are considered to be the most similar in structure?

1. Native tiger cat and domestic cat
2. Tiger and cougar
3. Domestic cat and cougar
4. Timber wolf and Tasmanian wolf

11. One hundred slaters (terrestrial arthropods) were placed in a temperature gradient chamber. Ninety-eight of the slaters eventually settled in an area with a temperature range of 24°-27°C. Two settled in an area with a temperature range of 33°-36°C. The most likely explanation for the behaviour of these two individuals is that

1. no two slaters are likely to behave in the same way
2. in most populations of organisms, a few individuals prefer isolation
3. individuals show variation in structure and behaviour
4. they preferred other temperatures

12. A fertilized egg cell is the product of the fusion of

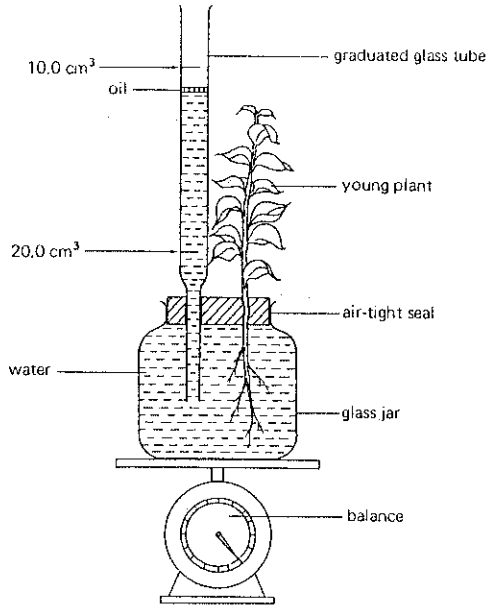
1. a gamete and a zygote
2. two gametes
3. two gonads
4. a gonad and an ovum

13. There is far more yolk in bird eggs than in mammal eggs because

1. mammals do not depend totally on the yolk for development
2. birds need more energy for development
3. birds develop more slowly and therefore need a greater supply of yolk
4. the yolk of a mammal egg is more concentrated

SEE PAGE 7

Question 14 is based on the following information:



The diagram above shows the apparatus used to measure the amount of water intake and water loss of a young plant. The results are recorded below. It is assumed that 1 cm³ of water weighs 1g.

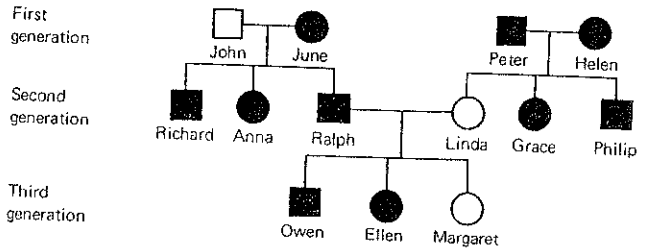
	Weight of the apparatus including plant	Readings of graduated glass tube
At the beginning of experiment	475.1g	10.2 cm³
After 30 hours	470.9g	15.6 cm³

14. The average rate of water loss in grams per hour was

1. 0.14
2. 0.18
3. 4.2
4. 5.4

SEE PAGE 8

Questions 15 and 16 are based on the following diagram which shows a pedigree of the ability to roll the tongue in two families. Squares represent males and circles females. Tongue-rollers are shown as solid black and non-rollers as blanks.



15. It can be inferred that Ralph received a gene for

    1. tongue-rolling from both parents
    2. non tongue-rolling from both parents
    3. non tongue-rolling from his mother
    4. non tongue-rolling from his father

16. If Peter and Helen were to have another child, what would be the chance of its being a non-roller?

    1. nil
    2. 25%
    3. 50%
    4. 75%

17. Variation in phenotypes is more likely to occur in offspring arising from meiotic rather than mitotic division because

    1. meiosis involves two divisions rather than one
    2. there is twice as much genetic information in a cell which divides meiotically
    3. meiosis only occurs in certain tissues
    4. there is random assortment of chromosomes at meiotic division

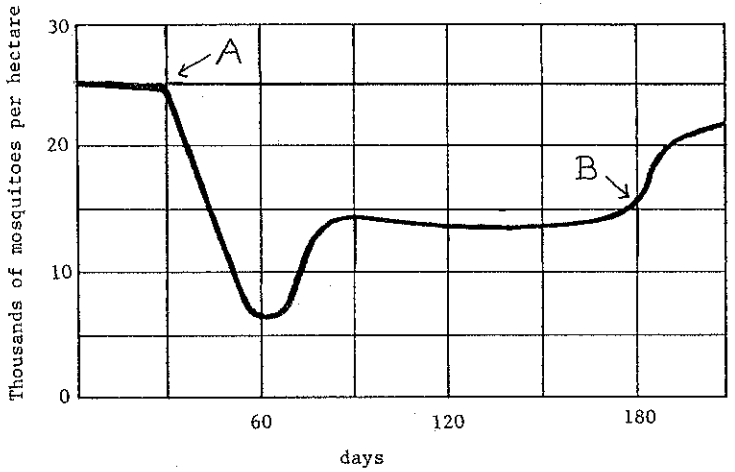
SEE PAGE 9

18. Although population numbers remain relatively constant over long periods, they fluctuate above and below the average. The regulation of populations has been called a form of homeostasis. Which best describes the relation of the fluctuations to homeostasis?

    1. The larger the oscillations, the more efficient the homeostatic mechanism
    2. The smaller the oscillations, the more efficient the homeostatic mechanism
    3. The more frequent the oscillations, the more efficient the homeostatic mechanism
    4. There is no relationship between oscillations and homeostasis

Question 19 is based on the following information:

A swamp was sprayed with DDT at weekly intervals in an attempt to eliminate mosquitoes. The results are shown in the graph below. The spraying programme began at A and finished at B



19. Doubling the concentration of the DDT at the time of the initial spraying probably would

    1. not have resulted in a 100% kill
    2. have caused the mosquitoes to mutate more rapidly
    3. have resulted in the same initial death rate
    4. not have altered the results of the campaign

SEE PAGE 10

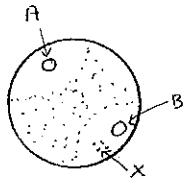
20. What is one probable advantage of a peck order?

1. It reduces energy spent in fighting for food and space
2. It enables specialization of behaviour patterns
3. It produces stronger chickens
4. It produces conformity

21. In 1971 the annual wallaby shoot at Avoca, Tasmania, resulted in almost 1500 wallabies being shot by 300 shooters. In 1972, 194 shooters took 896 wallabies. This information indicates that the wallaby population is

1. less in 1972 than in 1971
2. approximately the same in both years
3. reduced in 1972 to approximately half that of 1971
4. much affected by increased farming in the area

22.

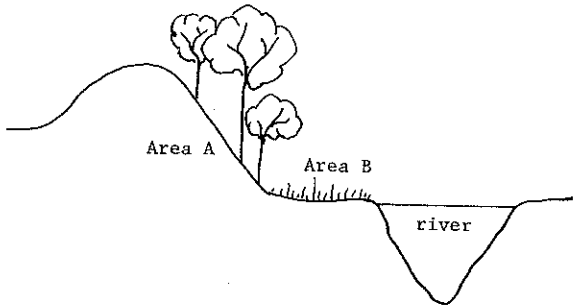


The above diagram shows a petri dish containing blood agar on which Bacillus subtilis colonies are growing. The bacteria are not usually found near the penicillin discs (A and B) although a few colonies (X) survive near B. The survival at X is probably due to the fact that

1. penicillin does not affect this species of bacterium
2. the penicillin in B is too weak to kill the bacteria
3. the bacteria at X have migrated into the empty space near the disc
4. these colonies grew from bacteria which had a resistance to penicillin

SEE PAGE 11

Question 23 is based on the following diagram



23. A farmer wishing to extend his grazing land clears area A of trees. If he then delays using this land, what effect would you expect on area B if the land is subjected to very heavy rainfall?

1. Death of some vegetation only
2. Increased erosion only
3. Leaching of soil only
4. A combination of 1, 2 and 3 above

Question 24 is based on the following table of energy levels of organisms in a salt marsh ecosystem.

Level	Energy (kilojoules/square metre/year)		
	taken in	lost during respiration	removed by tides
Plants	8660	6700	845
Herbivores	183	142	26
Carnivores	14	11	3
Decomposers	-	926	-

24. Much less of the energy captured by the plants is used by the carnivores than by the herbivores because

1. the carnivores are larger than the herbivores
2. there is less energy available to the carnivores
3. more energy is used by the decomposers
4. much of the energy is removed by tides

SEE PAGE 12

25. Oats and lucerne were grown under similar conditions in a nitrogen-deficient soil. The lucerne produced a healthy crop but the oats produced very straggly plants. The most probable explanation is that

    1. lucerne does not need nitrogen for growth
    2. lucerne can use other minerals in place of nitrogen
    3. lucerne seeds store enough nitrogen for prolonged growth
    4. lucerne can obtain nitrogen from sources other than soil solutions

26. DDT residues have been found in high concentrations in some carnivorous fish of the open oceans. Which of the following best explains this high concentration of DDT?

    1. DDT has been released in quantity over the open oceans
    2. Fish take in DDT from sea water
    3. DDT is not destroyed as it passes through the bodies of living things
    4. DDT has been found in rivers which drain into the sea

27. Very few protein molecules enter a cell because

    1. the proteins in a cell are specific to that cell
    2. proteins are basic (alkaline) and cells die under alkaline conditions
    3. few proteins have molecules small enough to pass through a cell membrane
    4. the cell membrane is basic, and since acids and bases attract, amino acids enter more easily than proteins

28. In mammals most enzymes cease to function when they pass from one part of the alimentary tract to another. Which one of the following is the most likely explanation of this generalization?

    1. The different substrates require a variety of enzymes
    2. Some enzymes will operate only in a relatively narrow pH range
    3. The enzymes are affected by temperature changes
    4. Absorption of the products of digestion has occurred

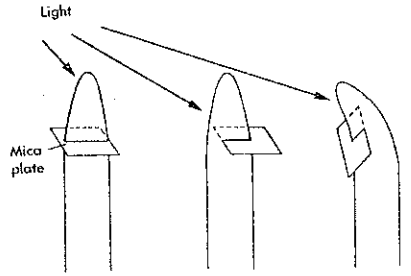
29. Hydra apparently cannot digest carbohydrates. Which of the following seems the most logical explanation for this?

    1. Enzymes to digest carbohydrates are absent
    2. Hydra cells do not use glucose in respiration
    3. Hydra is not able to take foods containing carbohydrates into its digestive cavity
    4. Carbohydrates cannot be broken down by animals that live in water

SEE PAGE 13

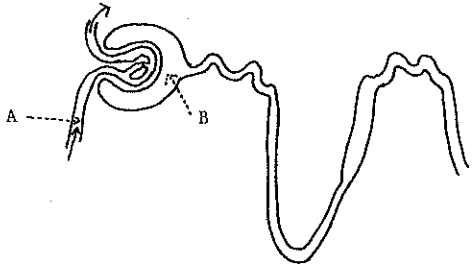
Question 30 is based on the following information:

In an experiment on the growth of plant coleoptiles, mica plates were inserted in different positions in three shoot tips which were then oriented in relation to a light source as shown in the diagram below. After several days, only one of the three coleoptiles exhibited curvature towards the light.



30. This experiment shows that

    1. there is a substance formed in the stem which causes increased growth in the tip of the shoot
    2. there is a substance formed in the tip of the shoot which slows growth on the side nearest the light
    3. there is a substance formed in the side of the tip nearest the light which slows growth of the shoot
    4. there is a substance formed in the tip of the shoot which increases growth on the shaded side



31. The above diagram represents a tubule from a mammalian kidney. By comparison with the liquid at A, the liquid in the tubule at B would contain

    1. more glucose
    2. more urea
    3. less protein
    4. more hormones

SEE PAGE 14

32. If a biologist wanted to investigate the genetic characteristics of living things, he would probably choose organisms which

    1. are animals
    2. reproduce rapidly
    3. are known to be pure lines
    4. possess dominant traits only

33. A greater number of enzymes is involved in the completion of aerobic respiration than in anaerobic respiration because

    1. aerobic respiration involves a greater number of chemical reactions
    2. aerobic respiration releases more energy
    3. anaerobic respiration involves a greater number of chemical reactions
    4. aerobic respiration is carried out by more complex organisms

34. Earlier humans took up a wandering way of life, moving constantly to new locations because

    1. of constantly changing environmental conditions
    2. they had horses and oxen to pull their belongings
    3. of religious beliefs that were adopted early in these groups
    4. game and edible plants became scarce from time to time

35. Which best illustrates an accomplishment of man which other animals could not achieve?

    1. Passing on written knowledge
    2. Organised labour systems
    3. Family unity and care
    4. Ability to learn

36. A student has a microscope with the following lens combinations:

ocular	objective
10	10
10	40

He uses the 10 x 10 lens combination and, by counting the millimetre markings on a plastic ruler, records the field of view as 2.5mm. By employing some simple mathematical calculations he estimates the 10 x 40 field of view to be

    1. 10 000 microns
    2. 2 500 microns
    3. 625 microns
    4. 250 microns

SEE PAGE 15

37. Glucose molecules are broken down to release energy. This energy can be used to make

    1. ADP from ATP because this reaction uses energy
    2. ATP from ADP because this reaction takes up energy
    3. ADP from ATP because this reaction takes up energy
    4. ATP from ADP because energy catalyzes this reaction

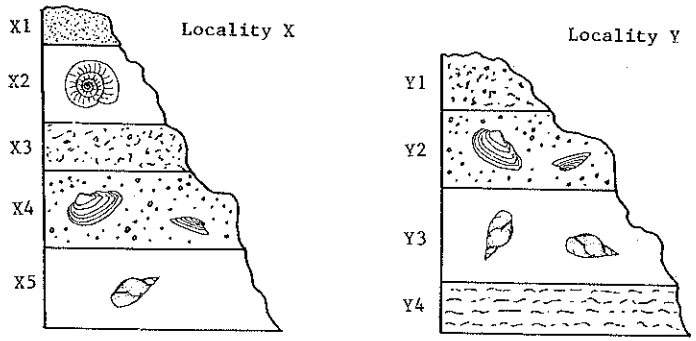
38. Which of the following does NOT act as a receptor?

    1. Lining of the small intestine
    2. Brain of a mammal
    3. Retina of the eye
    4. Foot of a fly

39. The mistletoe plant grows on the branch of a gum tree, penetrating the bark and drawing water and nutrients from the tree. However, the mistletoe has green leaves and can photosynthesize. The relationship between the mistletoe plant and the tree is referred to as

    1. mutualism
    2. predation
    3. parasitism
    4. competition

Question 40 is based on the following information:



40. The diagram above shows sequences of fossil-bearing rocks from two different localities X and Y. The flat coiled tubes are estimated to be 40 000 years old. The oldest layer of sediments would therefore be

    1. X1
    2. X4
    3. X5
    4. Y4

SEE PAGE 16

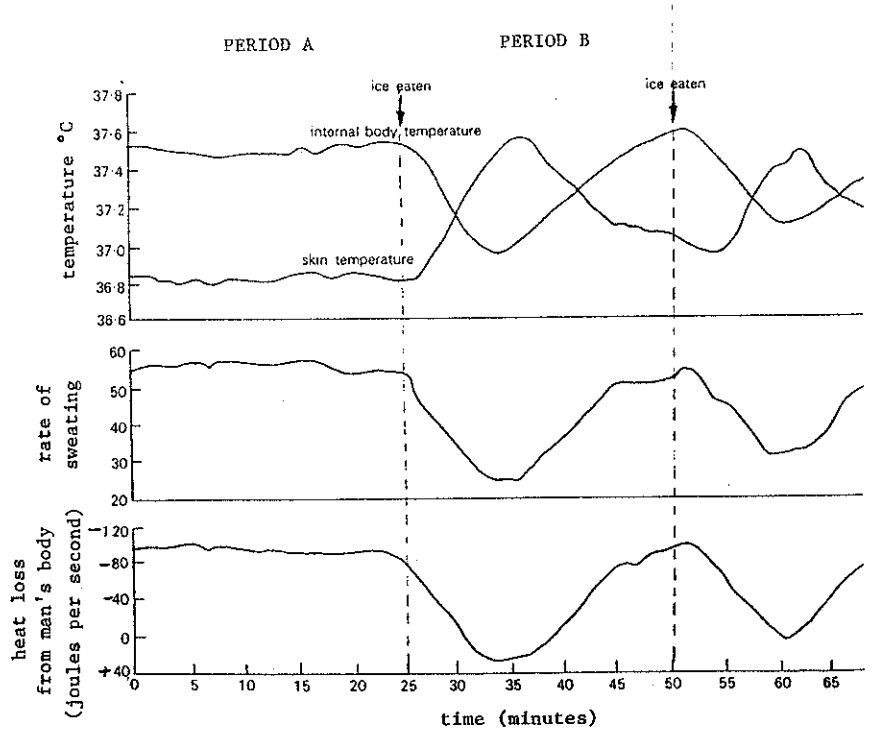
SECTION B

Suggested time: 75 minutes (36 marks)

Attempt all questions in this section.
Write your answers in the space provided.

41. (9 marks)

A man was resting in a temperature-controlled chamber which was kept at a constant temperature of 45°C. His body temperature, rate of sweating and body heat loss were measured, and the results plotted on graphs (see below). At the times shown he ate a quantity of crushed ice.



SEE PAGE 17

41. (continued)

(a) What happened to the following during the 25 minutes after the eating of ice?

(i) The internal body temperature _____

_____

(ii) The skin temperature _____

_____

(iii) The rate of heat loss from the body _____

_____

(b) During the first ten minutes after eating the ice, the skin temperature rose sharply.

(i) Why was this? _____

_____

_____

_____

(ii) Did this cause an increase in sweating? _____

_____

(c) How is the change in internal body temperature during period B related to the rate of sweating?

_____

(d) What does this experiment tell you about the location of the temperature detector?

_____

_____

_____

_____

SEE PAGE 18

42. (8 marks)

The following table gives measurements of different characteristics of oat plants over a period of ten weeks after the plants were sown.

Days from sowing	Height (cm)	No. of leaves	Wet weight (g)	Dry weight (g)
0	-	-	0.06	0.04
7	-	-	0.11	0.02
14	9.5	1	0.21	0.03
21	17.0	2	0.35	0.04
35	38.0	4	1.93	0.17
49	55.0	10	8.35	0.76
70	85.0	48	60.80	5.10

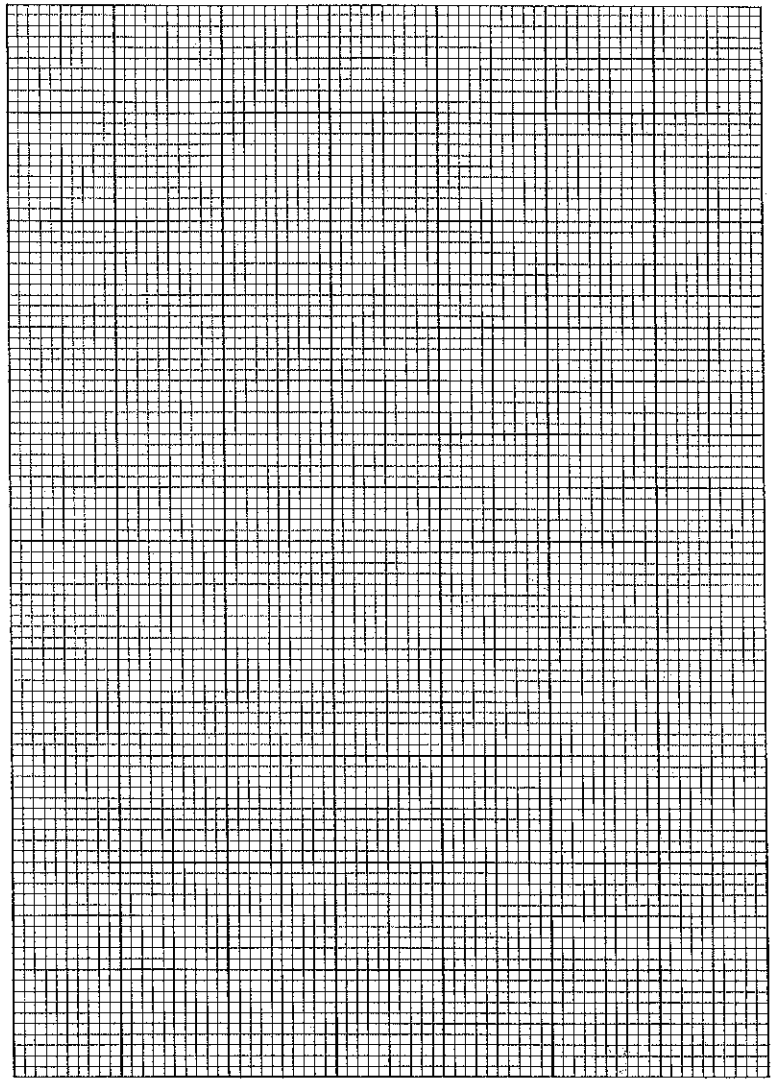
(a) Construct graphs for wet weight and for dry weight against days from sowing for days 0-49 only.

(b) Carefully list the advantages and disadvantages of each of the features - height, number of leaves, wet weight and dry weight - as a means of measuring the rate of overall development of the plant.

Advantages	Disadvantages

SEE PAGE 19

42. (continued)

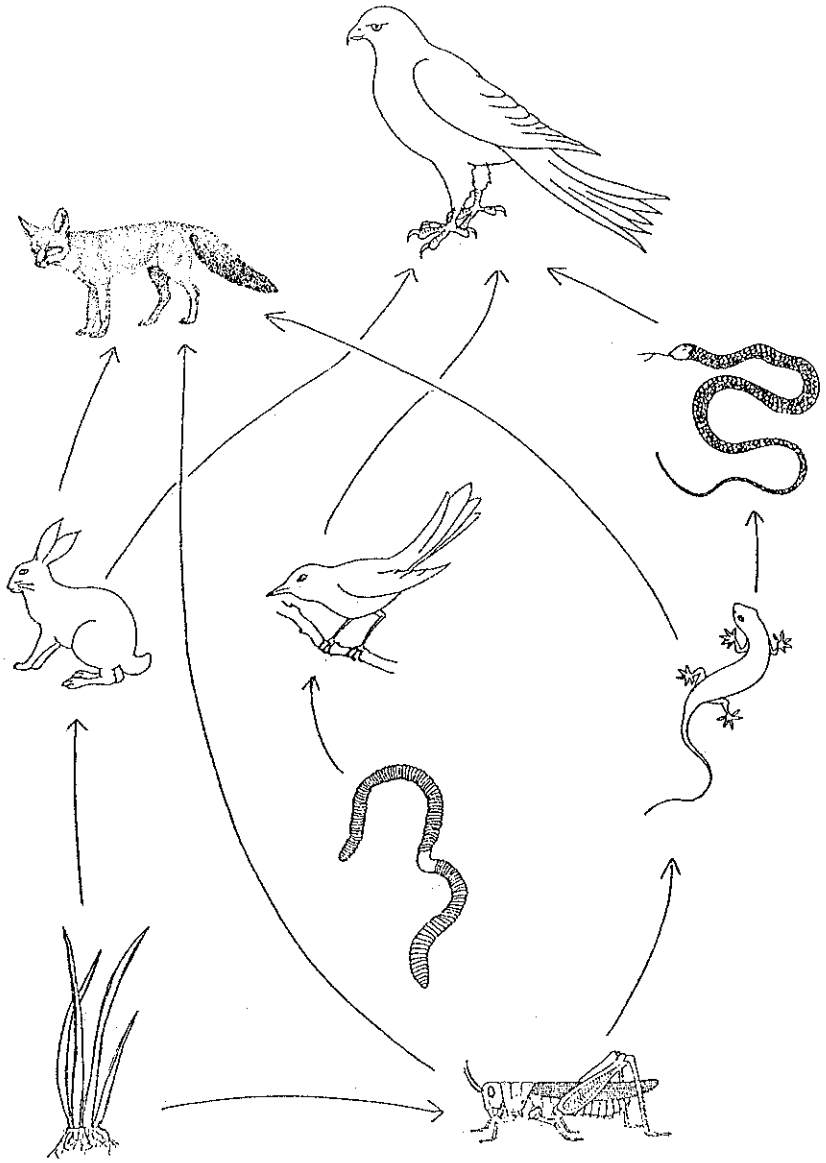


(The spare graph paper on page 35 may be used if you spoil this one)

SEE PAGE 20

43. (6 marks)

The diagram below shows a food web. The organisms are not drawn to scale.



SEE PAGE 21

43. (continued)

(a) Give a direct relationship involving the rabbit.

_____

(b) If there was a plague of grasshoppers, explain what effect(s) this would have on (i) the rabbits and on (ii) the earthworms?

(i) _____

_____

_____

(ii) _____

_____

_____

(c) Suggest 4 adaptive features of rabbits which enable them to survive in their environment.

_____

_____

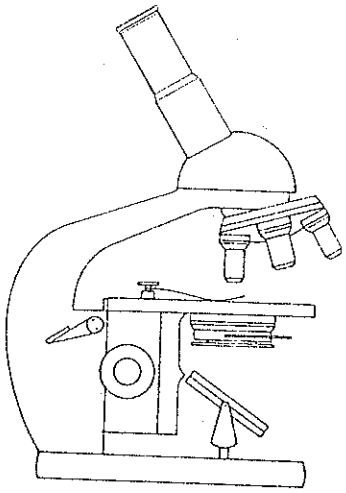
_____

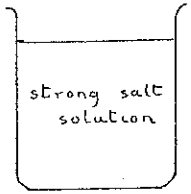
_____

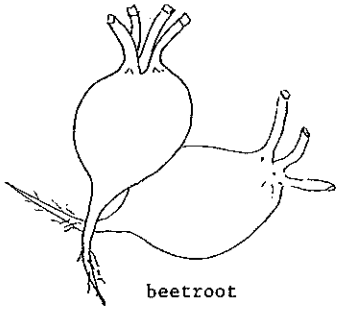
SEE PAGE 22

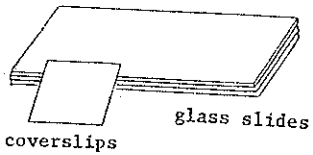
44. (7 marks)

A student has available the following equipment with which to demonstrate the osmotic reactions of beetroot cells.

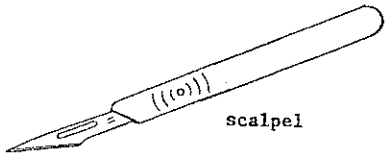


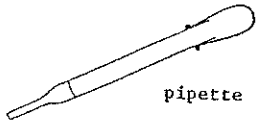



beetroot


glass slides

coverslips




pipette

SEE PAGE 23

44. (continued)

(a) Explain how the student would prepare some beetroot tissue for the experiment.

(b) What would she place on each slide?

(c) Describe what results she would expect to get from her experiment.

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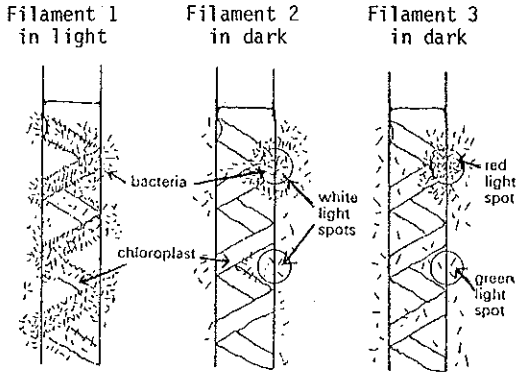
45. (6 marks)

T W Engelman, in 1883, performed a series of ingenious experiments to investigate the part played by chlorophyll in plants. He used aerobic bacteria and the filamentous Spirogyra in the three experiments shown below. Light of different colours was directed on to parts of the filaments.



(a) Why would aggregation of these bacteria demonstrate that photosynthesis was occurring?

(b) What does the distribution of bacteria around filament 1 show?

(c) Explain the results seen in filament 2.

(d) One hypothesis to explain (c) above could be simply that the bacteria are attracted to green light (ie white light shining through a chloroplast) but not to white. How does filament 3 refute this hypothesis?

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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.

46. EITHER

(a) Recall a field study you have made of EITHER an inland sandplain area OR a forest area. In your answer describe such things as the physical surroundings of the area, the types of vegetation present and their distribution, the consumers present and the relationship of the organisms to each other and to surrounding communities.

OR

(b) In the bodies of multicellular animals, specialised organs and systems selectively remove wastes and help to maintain a relatively stable environment.

Describe these systems and explain how their structure is related to the functions they perform.

OR

(c) In recent years much of Australia has suffered a long-term drought. This has caused considerable change in the components of each community. Some organisms have been able to persist while others have not survived.

(i) Describe the changes which take place in a drought-affected community

and (ii) List FIVE adaptations which you consider to be most likely to prevent the extinction of the species. Explain the reasons for your choice.

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47. EITHER

(a) "Human activities release a wide variety of substances which affect organisms directly or indirectly. These have produced great changes in the densities and distributions of a wide variety of organisms and affected the nonliving components of their environments. Effects may be widespread, difficult to predict and sometimes irreversible"

Write an essay about estuarine pollution, such as has occurred at Mandurah, explaining what has happened in the light of the above statement.

OR

(b) Angiosperms or flowering plants are usually referred to as true land plants. In nature, however, there always seem to be exceptions. One such exception is Posidonia, a seagrass commonly found in sandy bays. This marine plant has true flowers which produce pollen and ovules.

(i) Assume that you were asked to examine a Posidonia plant, what characteristics would you expect its root system, leaves and flowers to have which would differ from those of a land angiosperm?

(ii) Assume that you were asked to examine a cross section of a Posidonia leaf under the microscope. List the differences you would expect to find between Posidonia leaves and those of a similar terrestrial plant.

(iii) It is suggested that these observed differences are related to the differences in environment. Explain.

OR

(c) The eastern grey kangaroo, Macropus giganteus, and the red kangaroo, Macropus rufus, have been the subjects of distributional and nutritional studies in central Queensland. Results of this research are shown in the maps and table on page 27.

(i) Suggest the environmental factors which may have been responsible for the different distributions of the two species.

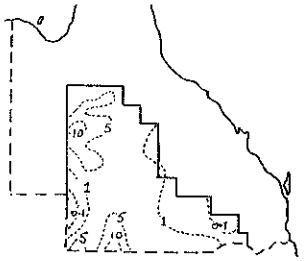
(ii) Explain why the two species are able to survive in the same region.

(iii) What conditions might change in the future? Explain how these changes might affect the distribution of the two species.

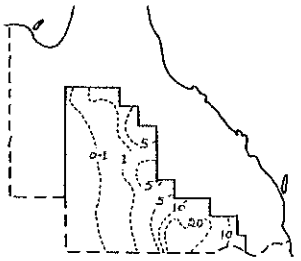
(iv) Sheep prefer mallow, mulga and beardgrass. What effects might increased sheep grazing pressure have on the numbers of the two kangaroo species?

SEE PAGE 27

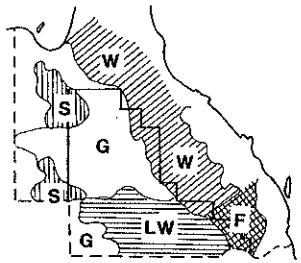
47.(c) continued



Numbers of red kangaroos per km²



Numbers of grey kangaroos per km²



Key

F = Forest
G = Grassland
LW = Low woodland
S = Shrub
W = Woodland

Vegetation map

TABLE OF FOOD PREFERENCES OF RED AND GREY KANGAROOS

Plant			% of total food intake of kangaroo	
			Red	Grey
Acacia aneura	(low tree)	mulga	1.3	0.0
Eremophila	(shrub)	buddah	6.6	2.2
Kochia	(shrub)	bluebush	15.1	13.2
Malva	(herb)	mallow	10.5	7.3
Portulaca	(herb)	pigweed	21.0	24.5
Aristida	(grass)	mulga grass	16.5	20.5
Amphipogon	(grass)	beard grass	15.1	17.6
Triodia	(grass)	spinifex	13.8	14.7

END OF PAPER