WESTERN AUSTRALIA

TERTIARY ADMISSIONS EXAMINATION,
1977.

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 TO BE PROVIDED FOR THIS PAPER:

Question paper comprising 41 pages and 47 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	46 a		
B	41				46 b		
	42				46 c		
	43				47 a		
	44				47 b		
	45				47 c		
	Sub-total B				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:

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.

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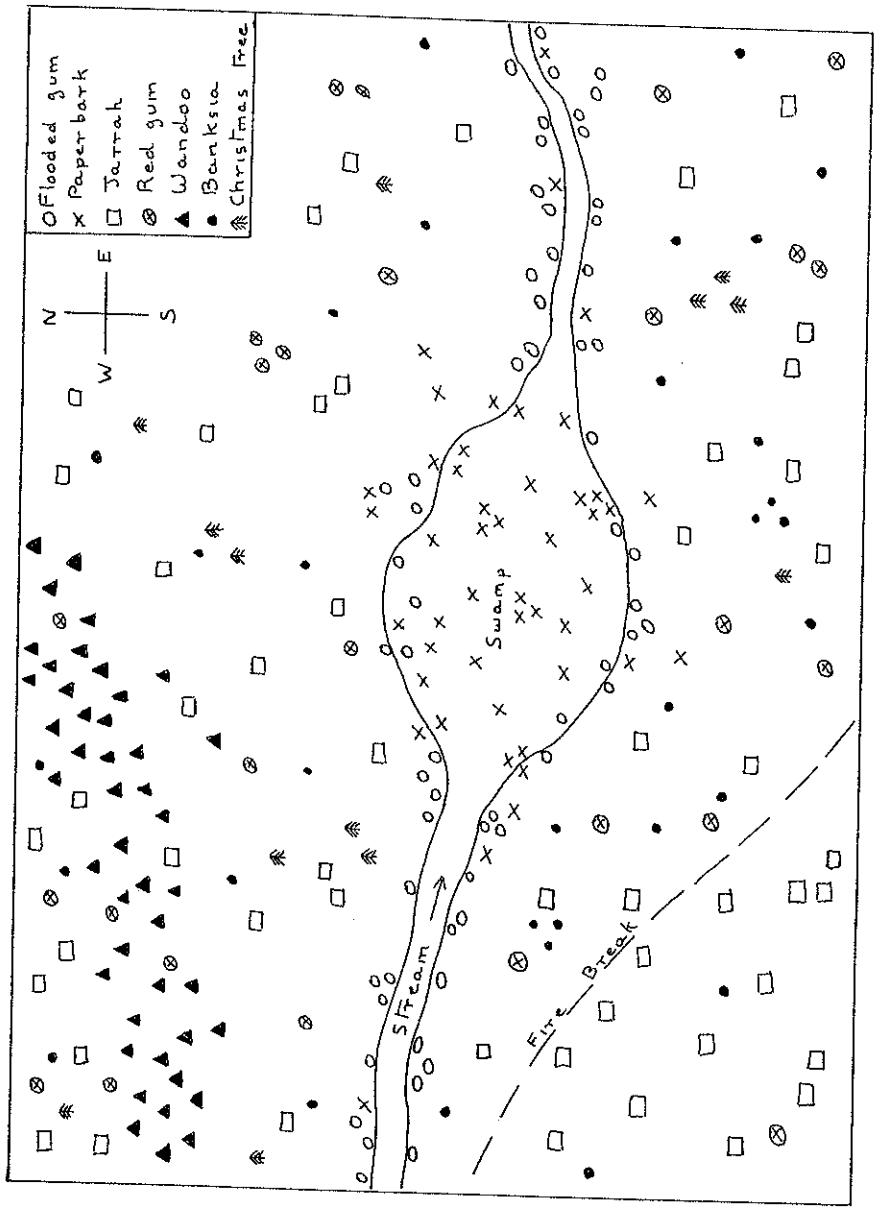
1. The influence of DNA is most directly associated with which of the following?
   1. Osmosis
   2. Dehydration
   3. Production of carbohydrate molecules
   4. Production of protein molecules
   5. Muscular contraction.

2. Mitochondria concentration is highest in which of these cells?
   1. Nerve cells
   2. Secretory cells
   3. Muscle cells
   4. Red blood cells.

3. A long time ago a species of flying squirrel inhabited an island. Ashes from a volcano on an adjacent island destroyed much of the vegetation including the trees. A few squirrels survived. Recently they were reported in abundance, living among rocks and shrubby growth that covers the land surface. In the present population there is a reduction in the presence of "wings" or flying membranes. The most probable explanation of this change is that
   1. a dominant mutant form was produced
   2. the "flying" habit was lost through disuse
   3. natural selection is taking place
   4. new genes appeared in the population
   5. genetic drift took place.

SEE PAGE 4

Questions 4, 5 and 6 are based on this map:



SEE PAGE 5

4. Which of the following would be the most appropriate name for the area mapped on page 4?

   1. Banksia-Wandoo community
   2. Jarrah-Red Gum community
   3. Christmas tree community
   4. Paper bark-Jarrah community
   5. Banksia swamp community.

5. *Eucalyptus rudis* (Flooded Gum) is seen to be concentrated in one part of the area. The most reasonable explanation for this is that

   1. these gums only live in dry soil
   2. these gums need an especially rich soil
   3. these trees can only grow partly submerged in water
   4. the seedlings of these trees can only survive dry summer weather if their roots remain wet
   5. the seedlings of these trees will only germinate in the shade of the adult trees.

6. Two students had been asked to lay a white cord so as to form a boundary between two communities in the northwest corner of the map. They could not agree on the correct position for the boundary. They should have been told that

   1. boundaries are not always clearly defined in nature
   2. boundaries are usually easy to define, but interference by man has probably made the boundary unclear
   3. a plant survey map from the University would indicate the true boundary
   4. communities are so mixed up in nature that separating one from another is a hopeless task
   5. a piece of cord long enough to deviate for every individual plant would be required.

7. A steam jacket is fixed around the trunk of a tree. When steam is passed through the jacket, all living cells in that part of the trunk are killed. Soon after the experiment one would expect to find that within the trunk

   1. no movement of fluids occurs past the dead area
   2. water and minerals continue to move but carbohydrates do not move past the dead area
   3. carbohydrates continue to move but water and minerals do not move past the dead area
   4. water, minerals, and carbohydrates continue to move past the dead area.

SEE PAGE 6

Questions 8 and 9 are based on the following information.

Chlamydomonas is a unicellular alga which can reproduce by division of its protoplasm to form daughter cells. This process occurs quite rapidly under ideal conditions (i.e. ideal for temperature, light, nutrients, pH, etc.).

A single cell of this species was introduced into a tank of nutrient solution which was maintained at an ideal temperature and placed in a well-lighted position.

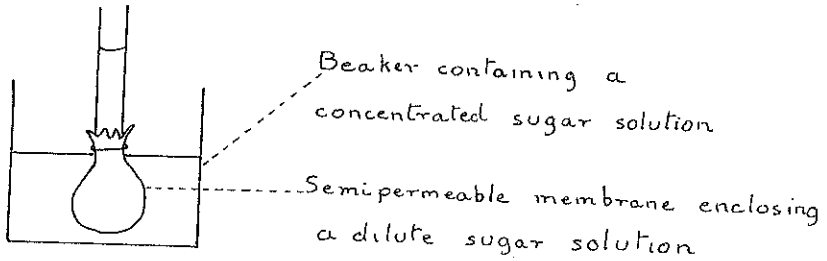
A research worker took samples from the tank at regular intervals and from these estimated the size of the algal population. His results are given below.

Day	1	2	3	4	5	6	7	8	9
Alga Population	32	80	150	300	700	1300	2600	5500	12000

8. From the data provided above it would be reasonable to expect the population on day 11 to be about
   1. 18000 cells
   2. 24000 cells
   3. 48000 cells
   4. 30000 cells
   5. 5000 cells.

9. A count of algal cells was made on day 11 and found to be far less than that predicted from the data. This lower cell count is most likely due to
   1. lack of care in counting on the part of the experimenter
   2. the cells beginning to die of old age
   3. the introduction of a competitor or predator
   4. increased rate of photosynthesis
   5. reduced level of nutrient in the culture solution.

10.

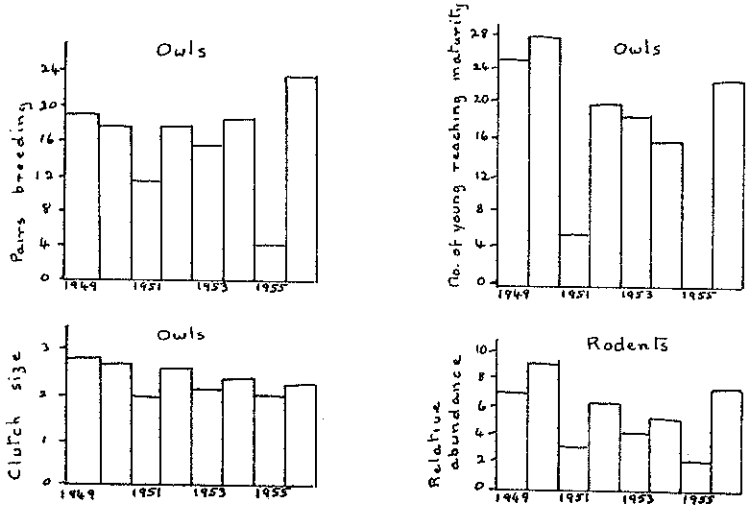


When osmosis occurs in the above experiment, some of the
   1. sugar molecules will move from the concentrated to the dilute solution
   2. water molecules will move from the concentrated to the dilute solution
   3. sugar molecules will move from the dilute to the concentrated solution
   4. water molecules will move from the dilute to the concentrated solution.

SEE PAGE 7

Questions 11 and 12 refer to the following information.

The results below were obtained by measuring the owl population in a 400 hectare woodland estate over a period of 8 years. The abundance of rodents was also estimated.



11. The number of owls present at the end of a given year is dependent on
   1. the number of pairs breeding
   2. the number of eggs laid by each pair
   3. the number of young reaching maturity
   4. all of the above factors.

12. On the basis of the above information the owl population would be expected to be the greatest at the end of the breeding season of which of the following years?
   1. 1949
   2. 1952
   3. 1954
   4. 1955.

SEE PAGE 8

Questions 13, 14 and 15 are based on the following information.

Daphnia, the water flea, sometimes appears red due to the presence of the respiratory pigment, haemoglobin, in its blood. At other times it appears colourless due to absence of the pigment.

Two experiments were done to investigate this difference:

Experiment 1

Some colourless *Daphnia* were put in water with a high oxygen concentration while others were put in water from which oxygen was gradually removed until the oxygen concentration was quite low. The first group remained colourless while the others turned red.

Experiment 2

Colourless *Daphnia* and red *Daphnia* were put in the same water with a very low oxygen concentration. The red *Daphnia* lived longer than the colourless ones.

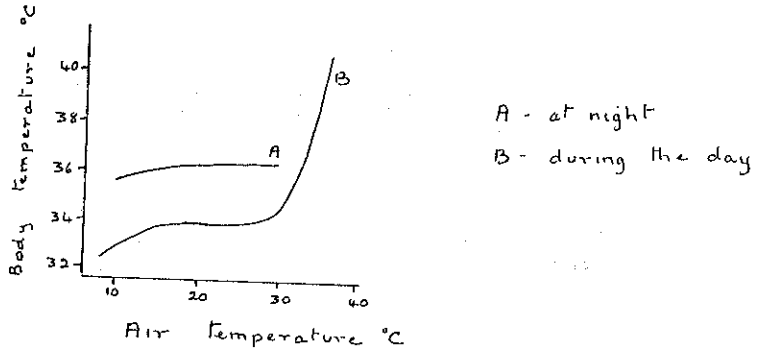
13. From the result of Experiment 1 it can be inferred that
    1. the presence or absence of haemoglobin in *Daphnia* is determined genetically
    2. colourless *Daphnia* are selected against as the oxygen content of the water gradually falls
    3. *Daphnia* can produce haemoglobin in response to low oxygen concentration
    4. *Daphnia* need haemoglobin for the absorption of oxygen.

14. From the results of Experiment 2 alone, it appears that
    1. *Daphnia* adjust to environments deficient in oxygen by producing haemoglobin
    2. *Daphnia* can produce haemoglobin in response to low oxygen concentrations
    3. colourless *Daphnia* are selected against in water of low oxygen concentration
    4. colourless *Daphnia* are selected against in water of high oxygen concentration.

15. From these observations and our present biological understanding it seems likely that *Daphnia* evolved in conditions of
    1. varying oxygen concentration
    2. stable oxygen concentration
    3. high oxygen concentration
    4. low oxygen concentration.

SEE PAGE 9

Questions 16 and 17 are based on the following graph which shows the body temperature of a nocturnally active opossum at different air temperatures.



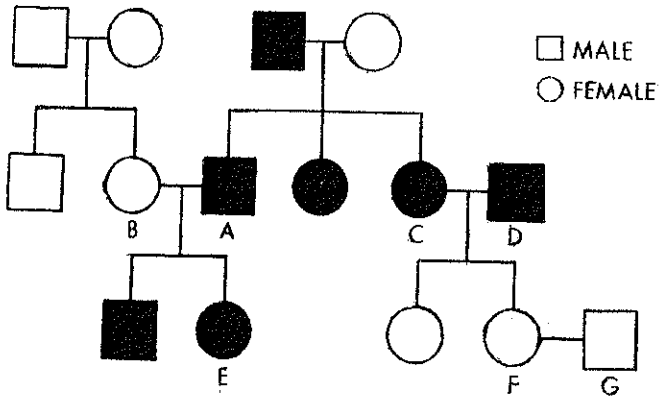
16. What is the normal resting temperature of the opossum?
    1. 30°C
    2. the same as the external temperature
    3. 4° higher than the external temperature
    4. 34°C
    5. 36°C.

17. What happens in the opossum's body if the outside temperature exceeds 30°C?
    1. It dies
    2. Its temperature remains constant
    3. Its homiothermic mechanism fails to compensate
    4. It perspires
    5. Its rate of energy production rapidly falls.

18. Animals such as the opossum which can maintain a high body temperature have an advantage over poikilotherms (ectotherms) in that
    1. they are more likely to survive very cold weather
    2. they can move faster
    3. their respiration and heart-beat rates are faster
    4. chemical changes in the body occur more quickly
    5. most animals prefer warm temperatures.

SEE PAGE 10

Questions 19, 20 and 21 are based on the following pedigree in which guinea pigs with black coats are shown in black and white-coated guinea pigs are represented by white. Circles represent females and squares represent males.



19. According to this pedigree, black coat colour in guinea pigs appears to be inherited as

1. a dominant trait
2. a recessive trait
3. an intermediate trait
4. a sex-linked recessive trait.

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

1. black from both parents
2. white from both parents
3. black from its male parent and the allele for white from its female parent
4. white from its male parent and the allele for black from its female parent.

21. The probability of getting black-coated offspring from a mating of guinea pigs B and D would be

1. 0
2. 0.25
3. 0.5
4. 0.75
5. 1.

SEE PAGE 11

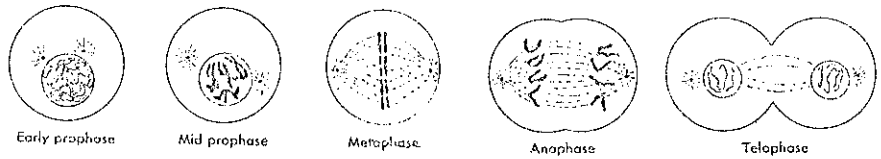
22. A substance was isolated from the blood of an animal and chemically analysed. It was found to contain the elements Carbon, Nitrogen, Oxygen and Hydrogen. It was probably

1. a sugar
2. a fat
3. an amino acid
4. glycogen.

23. The number of chromosomes per cell typically

1. is constant for all cells in both sexes of a species
2. is constant for all cells
3. fluctuates from individual to individual within a species but is constant for all somatic (body) cells within an individual
4. fluctuates from tissue to tissue within an organism
5. is constant for all somatic cells in a species.

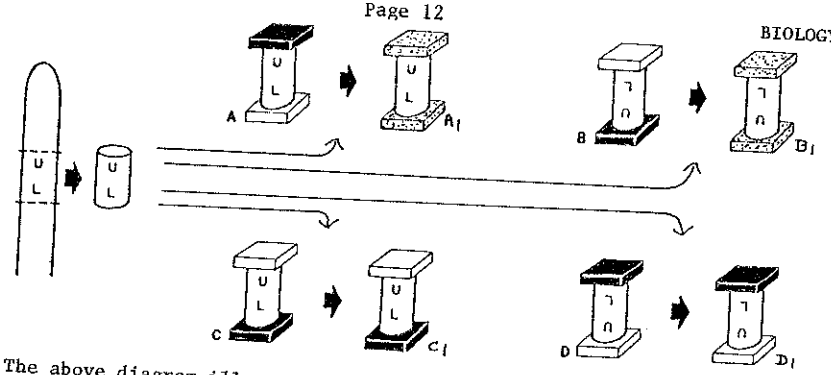
24. The phases of mitosis are shown in the diagrams below.



In this type of division

1. chromosomes split lengthwise into daughter chromosomes during metaphase
2. chromosomes split lengthwise into daughter chromosomes during prophase
3. chromosomes split lengthwise into daughter chromosomes during anaphase
4. paternal and maternal chromosomes pair and are separated from each other by the division
5. chromatin does not condense into chromosomes until the sperm enters the cell.

SEE PAGE 12



25. The above diagram illustrates four experiments to determine the direction of auxin movement. Segments were cut from a coleoptile of a plant and agar blocks were placed on each of the cut ends of each segment. The black blocks contained auxin, the white ones lacked auxin and the stippled blocks show that some auxin was found in them. Segments A and C were not inverted while B and D were turned upside down. The results are seen in A_1, B_1, C_1 and D_1 and from these one can conclude that

1. auxin can move both upwards and downwards in a coleoptile
2. gravitational pull is responsible for the movement of auxin
3. auxin can only move upwards in a stem
4. auxin diffuses down its concentration gradient
5. auxin only moves downwards in the intact plant.

26. A farmer may grow a crop of legumes in his wheat field one year. The chief purpose of doing this is

1. to allow the field a "fallow" period
2. to return nitrogen compounds to the soil
3. so that the farm economy does not depend solely on one crop
4. to provide feed for farm animals
5. to prevent the growth of unwanted weeds.

27. A biologist studying the physiology of flight in insects found that a small fly could be induced to vibrate its wings for up to three hours when it was attached by glue to the head of a pin. At the end of this time it could not be stimulated to begin flying again unless it was fed on a solution of sucrose. The most appropriate explanation of this observation is that

1. the fly is too tired after three hours to fly again
2. sucrose is a source of energy for flight
3. sucrose removes the waste products of muscle action
4. flies need sucrose to live
5. sucrose is needed in order for the fly to respond to stimuli.

SEE PAGE 13

28. Energy consumption of the heart is very much greater than that of the brain in vertebrates. One significant reason for this is that

1. muscle activity involves movements of greater mass than does nervous activity
2. muscle contraction is much faster than nervous transmission
3. muscle cells are much longer than nerve cells
4. muscles contain much more fatty material than nerve tissues
5. muscle activity invariably follows nerve activity in time.

29. With respect to enzymes, which of the following is true?

1. Enzymes must be in high concentrations to be effective
2. Enzymes in living cells may alter the speed of reactions
3. Enzymes are used up in the reactions they control
4. One enzyme can and usually does catalyze several different reactions.

30. The inside of the lungs of a vertebrate animal is sometimes considered to be outside the organism. This idea might reasonably be based on the fact that

1. the inside of the lungs is directly connected to the outside environment
2. in order to reach the blood, oxygen molecules must pass through the cells of the capillary walls
3. the contents of the lungs have a composition which is not related to the functioning of the organism's body cells
4. simple physical laws can explain the exchange of gases between blood and lungs
5. the water content of the air in the lungs is the same as that of the air outside the animal.

SEE PAGE 14

31. Organs of an insect's body are supplied with a system of branching blood vessels in which colourless blood flows slowly. They are also connected to a system of branching air-filled tubes called tracheae which open to the body surface by spiracles.

Oxygen for cell metabolism is transported from the outside by

1. circulation of the blood
2. movement of muscles
3. direct diffusion from the body surface
4. air currents over the body surface
5. gaseous diffusion in the tracheae.

32. Waste products of cell metabolism include CO_2 and nitrogen compounds.

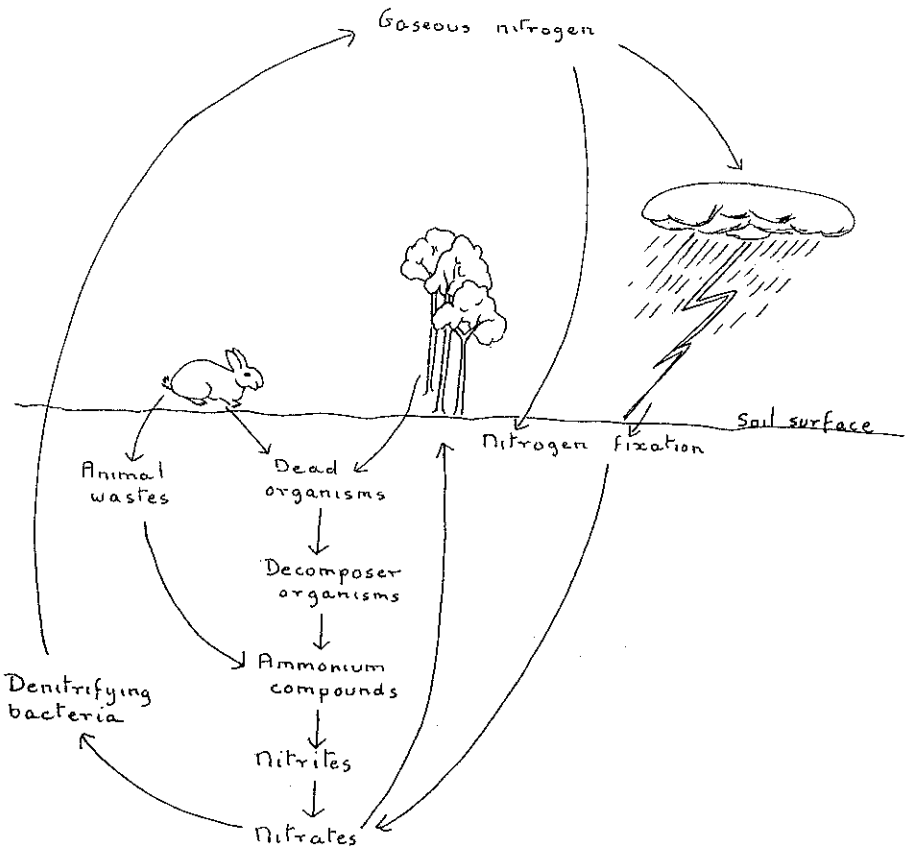
In insects

1. blood removes the nitrogen compounds and the CO_2 escapes through the tracheae
2. blood removes both CO_2 and nitrogen compounds
3. CO_2 and nitrogen compounds escape through the tracheae
4. nitrogen compounds are converted to solids and CO_2 is removed by the blood.

33. 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.

SEE PAGE 15

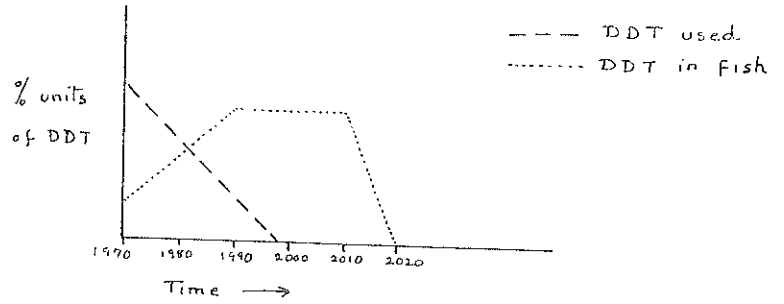


34. The diagram could be completed by the addition of an arrow indicating the

1. conversion of nitrogen compounds into gaseous nitrogen
2. conversion of gaseous nitrogen into nitrogen compounds
3. conversion of nitrites into nitrates
4. absorption of nitrates by plants
5. transfer of plant protein to animal protein.

SEE PAGE 16

35. In the graph below, predictions are made about what will happen to the level of DDT in fish if the use of DDT is phased out after 1970.



Which one of the following is a reasonable deduction that can be drawn from these data?

1. It is too late to stop using DDT
2. All the fish we eat contain considerable amounts of DDT
3. Fish containing DDT live longer
4. DDT is passed along food chains
5. The fish population will fall rapidly during the next fifty years.

36. In 1974 R. T. Bakker published a paper claiming that birds should be regarded as modern day dinosaurs - i.e., that the dinosaurs and birds should be included in a single class, Archosauria, separate from the class Reptilia.

Which of the following statements best supports such a classification system?

1. There is evidence that dinosaurs, like birds, were homiothermic (warm-blooded)
2. Dinosaurs, like birds, laid eggs
3. *Archeopteryx*, a primitive bird, lived at the time of the dinosaurs
4. Some modern birds cannot fly but run on the ground
5. Both 1 and 2.

SEE PAGE 17

37. Mammals are said to have a 'double circulatory system'. This means

1. that the blood vessels are paired, e.g. artery to each leg, etc.
2. that there are two types of blood vessel attached to every organ - an artery and a vein
3. that the blood circulates twice as quickly
4. that there are two systems - one from the heart to the lungs and back to the heart, and the other to and from the rest of the body.

38. In man all <u>except</u> which one of the following are vestigial structures?

1. the vermiform appendix
2. muscles for moving the outer ear
3. body hair on the trunk
4. the coccyx
5. the urinary bladder.

39. Darwin concluded that

1. <u>only</u> those forms which are <u>best</u> suited for a <u>given</u> environment survive
2. many structures are found in plants and animals which cannot be shown to have survival value
3. in evolution, cooperation is more important than competition
4. "natural selection" explains the causes of variation
5. those variants which are better adapted to an environment will reproduce in greater numbers.

40. The dog, the jackal, and the coyote all belong to the genus *Canis*. They all belong to different species, however, because

1. while they possess superficial similarities, they are competitors for food in the same ecological community
2. while they look somewhat alike they are natives of different parts of the world
3. they were discovered by man over wide intervals of time and were classified into separate categories
4. they cannot interbreed and produce fertile offspring
5. the system of classification has been perfected to a point where it is infallible.

SEE PAGE 18

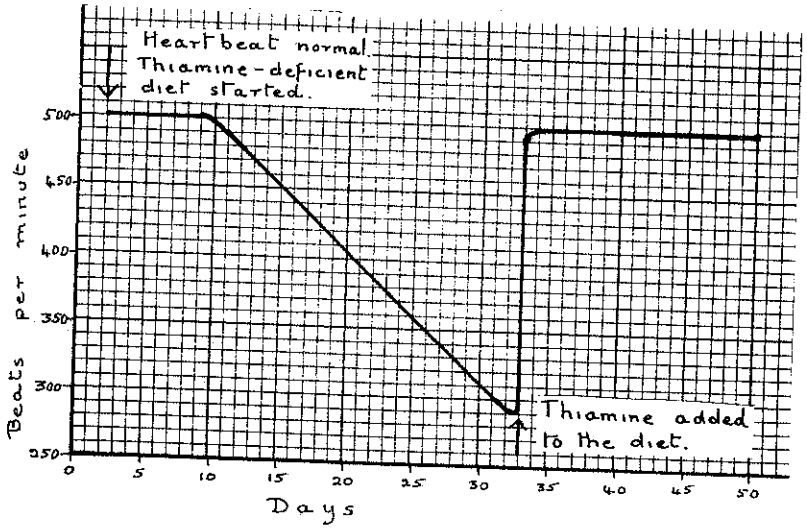
SECTION B

Suggested time: 75 minutes (36 marks)

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

41. *(8 marks)*

The graph below shows what happened to the average rate of heartbeat in a group of rats when they were fed on a diet lacking in vitamin B1 (thiamine). Normally thiamine is found in large quantities in the heart.



(i) Why is it better to use a group of rats rather than just one rat?

(ii) After vitamin B1 is withdrawn from the diet how long does the heartbeat remain normal? Suggest why the heartbeat remains normal for that period before it decreases.

SEE PAGE 19

41. (continued)

(iii) What is the effect of adding thiamine after day 33?

(iv) Suppose you had 10 rats which had been fed on a diet lacking in vitamin B1 for 30 days. How could you test several different foods to compare the amounts of vitamin B1 present?

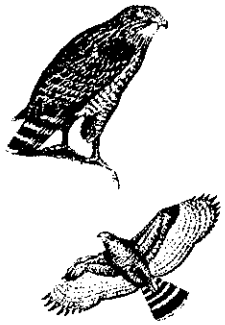
SEE PAGE 20

42. *(6 marks)*

A biologist seeking to determine the degree of relationship between three broad-winged hawks, *Buteo swainsoni*, *B. platypterus* and *B. lineatus*, gathered the data shown below.

Buteo swainsoni
(Swainson's hawk)

Buteo platypterus
(broad-winged hawk)



Buteo lineatus
(red-shouldered hawk)

Some characteristics of *Buteo* hawks.

	1	2	3
CHARACTERISTIC	SWAINSON'S HAWK	BROAD-WINGED HAWK	RED-SHOULDERED HAWK
a. length of outer flight feather	36.5 cm	27.7 cm	29.7 cm
b. length of beak	2.9 cm	2.8 cm	3.6 cm
c. width of beak (no lines drawn)	1.7 cm	1.5 cm	1.7 cm
d. distance between angle of beak and eye	.3 cm	.6 cm	.9 cm
e. usual hunting behavior	glides over open land	hunts from perch	hunts from perch
f. distribution	west of Great Plains	east of Great Plains	from Atlantic to Pacific oceans
g. amount and width of banded coloration on tail feathers	See Figure		

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SEE PAGE 21

42. (continued)

(i) Which two species do you consider to be most closely related?

(ii) Which combination of the characteristics in the table supports your answer above?

(iii) Of those characteristics listed in (ii), which is/are most significant in determining the relationship?

(iv) What can you infer by relating characteristics a and e ?

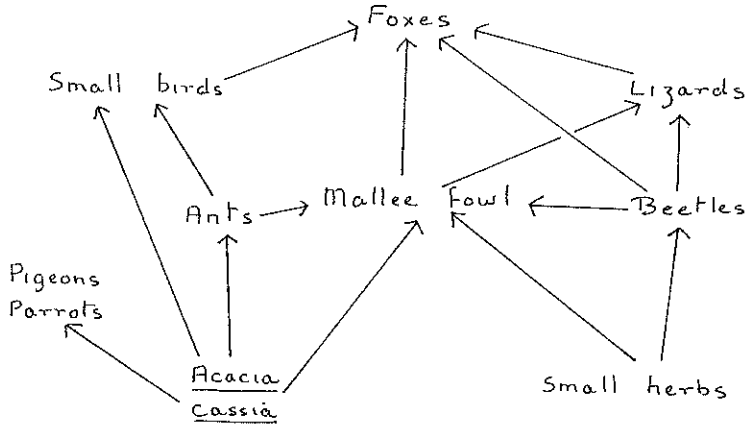
SEE PAGE 22

43. *(11 marks)*

A mallee scrub community is made up of species of *Eucalyptus*, a shrub layer of *Acacia* and *Cassia* and several species of herbaceous annuals (herbs). During winter and spring the herbs provide buds and flowers as food for the mallee fowl but as increasing summer heat diminishes this food supply, the birds feed on fruits on the smaller shrubs. In January, *Acacia* and *Cassia* seeds begin to fall and serve as the main food source for mallee fowl until the approach of winter when herbs become available once more. The birds will consume any seed-eating ants and beetles they encounter.

Pigeons, parrots, other small birds, ants and beetles share the mallee fowls' main diet, the *Acacia* and *Cassia* seeds.

Foxes eat 35% of eggs laid by the mallee fowl although they also consume beetles, small birds and lizards, while some lizards will make a meal of any exposed mallee fowl eggs they find.



Food web of the Mallee community

(i) What was the original source of the energy which was used by the lizards?

(ii) Which group of organisms would need to be present to complete a nutrient cycle with the plants and animals shown in the food web?

SEE PAGE 23

43. (continued)

(iii) Explain why the amount of energy available to the foxes differs from the amount of energy available to the herbivores.

(iv) A field worker has observed that in a summer when there is an unusual increase in the number of parrots, there is a significant decrease in the number of beetles. Suggest an explanation for this.

When examining a mallee fowl nesting mound, it was possible to determine whether foxes were visiting it. Explain each of the following observations.

(v) After poisoned eggs, which had been placed in a mound, were eaten, destruction of eggs by foxes immediately stopped on that mound and on six other mounds in the area that had previously been raided.

In view of your answer to (v), explain why

(vi) one month later some of the mounds were again raided by foxes.

In view of your answers to (v) and (vi), explain why

(vii) two mounds not previously visited were also raided.

SEE PAGE 24

44. *(7 marks)*

Research workers in Western Australia observed that in some forest areas the mycorrhizal fungi were in such low numbers that the percentage infection of pine tree roots would be small. They placed various fungal hyphae that were absent from local soils in close contact with *Pinus radiata* seedlings in trial plots set up in an established pine plantation. The following table shows some results obtained when inoculated trees were sixteen months old.

Fungal inoculum	Death of seedlings %	Average height (in cm.)	Total growth of side shoots No. x Length (in mm.)
Rhizopogon luceolus	5.3	40	85
Boletus granulatus	5.3	41	78
Boletus luteus	21.3	35	55
Control (no inoculum)	17.3	29	58

(i) Which fungal inoculum produced the best survival of pine seedlings?

(ii) From the data, what are the effects of inoculation of a desirable fungus on pine seedlings?

(iii) From the data presented it appears that the association of the fungal hyphae and the pine roots is of benefit to both organisms. What do we call such a relationship?

(iv) Suggest how each member of this association might benefit.

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45. *(4 marks)*

Albinia and Smidgia are two neighbouring kingdoms. The ratio of albinos (cc) to non-albinos (CC or Cc) is about the same in both kingdoms. The inhabitants of Albinia, influenced by race propaganda, decide that the only true Albinian is one who is an albino. They set out, by drastic laws governing matings, to produce a pure albino population. The nationalists of Smidgia, on the other hand, favour only non-albinos and introduce similar laws aimed at producing a 100% pure non-albino population.

(i) Which kingdom will arrive at its goal first?

(ii) Explain your reasoning by referring to the genotypes and phenotypes in each kingdom.

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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.

46. EITHER (a)

"Living systems require energy." Use the following headings to explain this statement with reference to a green cell of a plant.

(i) the source of the energy

(ii) the uses to which it is put

(iii) the transformations which it undergoes

(iv) the ways in which it is stored and lost in the system.

OR (b)

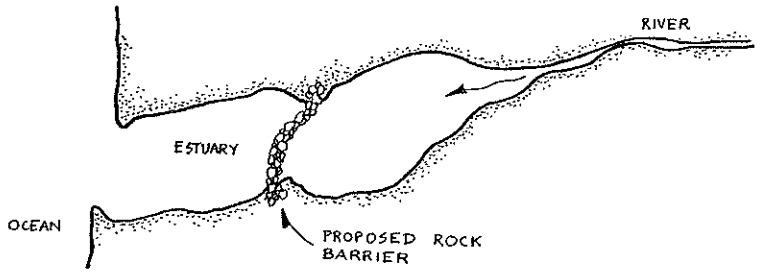
It is proposed to build a rock barrier across a large river approximately midway along the tidal region of the river's estuary. Fresh water would still pass out to sea but salt water would not enter the river above the barrier. This region contains primary producers (e.g. marine phytoplankton), first order consumers (e.g. marine zooplankton and small crustacea), second order consumers (e.g. marine molluscs, crabs, fish), third order consumers (e.g. fish, wading birds) and other organisms that feed on organic debris (e.g. marine worms and bivalve molluscs).

What effect would the barrier be likely to have on the existing ecosystem? Base your answer on the following headings:

(i) physical environment

(ii) biological communities

(iii) productivity.



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46. (continued)

OR (c)

Despite its size, the tiny, soft-bodied lucerne flea (shown in fig. 1) is one of the most damaging pasture pests in Australia. Even in the absence of predators young lucerne fleas divide their time between feeding on growing plants and crawling about on the ground eating soil and dead adult fleas. Numbers of fleas often rise to 15 000 per square metre, only to crash suddenly to a few hundred insects. Mr. Wallace of CSIRO noticed that under crowded conditions, numerous fleas hatched but few attained maturity. The death rate of young fleas was closely related to the number of dead adults. Such adults contained high concentrations of uric acid which built up to a lethal level in the juvenile insects.

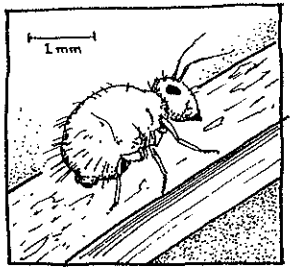

FIGURE 1: ADULT FLEA ON LEAF.

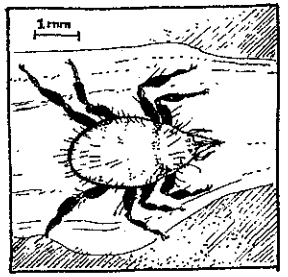

FIGURE 2: ADULT MITE.

A bdellid mite (fig. 2) is the main predator on the flea but does not completely control it. The distribution of both flea and mite is shown in fig. 3.

As a last resort a Moroccan mite, *Neomolgus*, was introduced to one pasture area in Western Australia and fig. 4 shows the result.

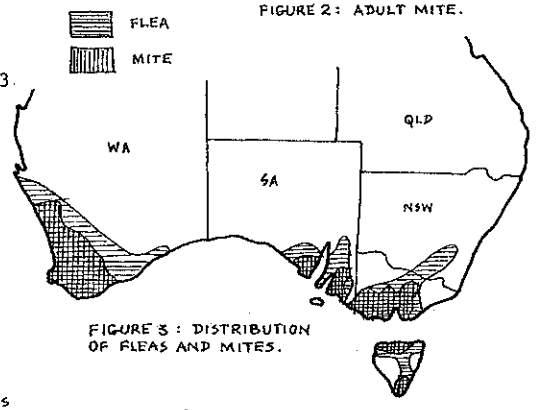

FIGURE 3: DISTRIBUTION OF FLEAS AND MITES.

(i) Define the term 'population'.

(ii) What factors may be responsible for changes in the size of an animal population?

(iii) Use the data given above to explain how each of the factors listed in (ii) could be operating to affect the population size of the lucerne flea.

(iv) Explain what scientists must have considered while planning the biological control of the lucerne flea.

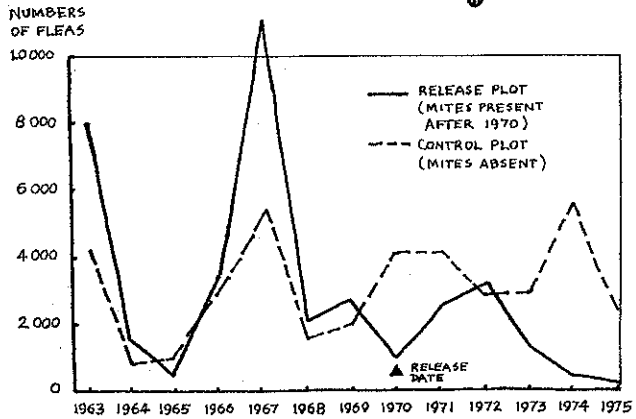

FIGURE 4: POPULATIONS AT WADDI FOREST IN WESTERN AUSTRALIA.

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47. EITHER (a)

In 1858, the famous physiologist Claude Bernard proposed that the major function of all physiological processes is to maintain the constancy of the internal environment. Mechanisms directed towards this end are now known as homeostatic mechanisms (e.g. regulation of temperature, oxygen supply, water, hormone concentrations). Regulation of the internal environment enables an organism to be relatively independent of fluctuations in the external environment. Nevertheless, such independence is only possible if the organism is continuously interacting with its external environment.

Discuss the above statement by answering the following questions.

(i) What is meant by the 'internal environment'?

(ii) Describe one example which illustrates how a homeostatic mechanism permits an organism to cope with fluctuations in the external environment.

(iii) What are the advantages to a species of such independence from the external environment?

OR (b)

The use of newly developed tools and techniques has helped in the advancement and refinement of our understanding of the living world. Radioisotopes, for instance, have been used in research on

(i) cellular biochemistry

(ii) systems of an organism

(iii) past ecosystems.

Explain the importance of radioisotopes in the development of our knowledge by fully describing one example of its use in each area listed above.

Radio Isotopes Now Used In track WA Many Field

Isotopes to

termites

Perth gets most fallout in Aust.

RADIATION IN PERTH'S MILK

No radiation safe, we tell U.N.

NUCLEAR FALLOU GREATER IN NO

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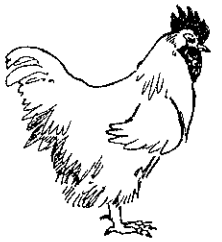
47. (continued)

OR (c)

In fowls a genetic defect may occur known as 'creeper' (see figure below).

NORMAL ROOSTER



CREEPER ROOSTER

SMALLER HEAD, SPLIT EYES, NO EYELIDS, MISSHAPEN HEAD, SMALLER BODY, DEFECTS IN SKELETON, SMALL WINGS AND SHORT LEGS.

(i) A number of creeper fowls were intercrossed and 160 offspring were hatched, of which 104 were creepers and 56 were normal. Show how these results support the hypothesis that the parent creeper fowls were heterozygous, creeper being dominant to normal, rather than any alternative genetic pattern.

(ii) In view of the F_1 genotypic ratio that we might expect in the offspring and if the data given in (i) are typical for creeper in fowls, explain the observed phenotypic ratio.

END OF PAPER