WESTERN AUSTRALIA

TERTIARY ADMISSIONS EXAMINATION, 1978

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.

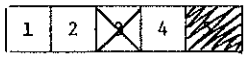
You MUST NOT take this question paper away from the examination room.

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.

1. Which one of the following organisms does NOT contain a photosynthetic pigment?
   1. A red alga
   2. A green mould
   3. A liverwort
   4. A red-leafed tree (e.g. Prunus).

2. Lichens are not usually classified into a phylum. The reason for this is that
   1. they vary in colour (black, orange, grey, green)
   2. some are leaf-like while others form a crust on rocks
   3. the body of the lichen is made up of fungal hyphae and algae
   4. they are found in an extremely wide variety of environments from the equator to the Pacific.

3. Which kind of cell would consume least oxygen?
   1. Xylem elements
   2. Phloem sieve tubes
   3. Parenchyma
   4. Cambium.

SEE PAGE 4

4. In which of the following do viruses differ from cellular organisms?

   1. They multiply in the living tissues of animals and plants
   2. They contain genetic material
   3. They can be crystallised
   4. They can be studied under the electron microscope.

5. Bile is important because it

   1. acts as a hormone that stimulates the pancreas
   2. has an enzyme that acts on fats
   3. emulsifies fats
   4. provides a suitable medium for the action of pepsin
   5. has a starch-splitting enzyme.

6. Cyclone Alby left a wake of destruction on April 4th, 1978. One of the obvious results was the "burnt" and dehydrated leaves on both soft and hard leaf trees. The high winds were accompanied by 100% humidity and elevated temperatures. The reason for the effect on the trees would have been

   1. the wind bent the tree trunks, blocking transpiration and stopping the water supply to the leaves
   2. the temperature and wind evaporated soil moisture which supplied the leaves via the roots and stems
   3. the wind shook the branches to such an extent that water was thrown from the leaves
   4. the high humidity caused the stomata to stay open, thus causing excess transpiration.

7. When a section of a plant stem was flooded with iodine solution, dark spots appeared in parenchyma in the centre of the stem. The most likely explanation for this is that

   1. these parenchyma cells can make starch by photosynthesis
   2. these parenchyma cells can make starch from sugars
   3. starch diffuses into these parenchyma cells from elsewhere
   4. all of the above are correct.

SEE PAGE 5

8. Which of the following does NOT support the belief that the blood circulates through the body in one direction?

   1. People who suffer from hardening of the arteries tend to have poor circulation in the lower limbs.
   2. Closing off (with clamps) both venae cavae and the pulmonary vein in an anaesthetized experimental animal causes the two atria (auricles) of the heart to collapse
   3. If the aorta and pulmonary artery are closed off in an anaesthetized animal the two ventricles of the heart tend to swell up
   4. Blocking of an artery in a live animal causes an accumulation of blood in that artery on the side toward the heart
   5. Cutting a large artery in a live animal causes blood to spurt out from only one cut end.

9. ATP is important in living cells because it is

   1. a high energy compound which participates in many chemical reactions
   2. a phosphate compound used in protein production
   3. an enzyme which aids in photosynthesis
   4. a byproduct of respiration.

10. Among animals competition between members of the same species is usually more intense than that between members of different species. The most probable explanation for this is that

    1. there is considerable variation among individuals even though they are of the same species
    2. members of the same species have almost identical requirements
    3. members of the same species instinctively know each other's behaviour patterns and are thus better equipped to compete with one another
    4. members of the same species may be organized into a special hierarchy.

11. Two species which belong to the same genus are usually assumed to

    1. occupy the same ecological niche
    2. have the same reproductive behaviour
    3. be indistinguishable from each other without close study
    4. have a relatively recent common ancestor.

SEE PAGE 6

12. Which one of the five statements below would be considered a principle (major idea)?

1. All living organisms have living enemies which compete with them for available food
2. The outer germ layer of the embryo is known as the ectoderm
3. In 1977 women students at the University of Western Australia were 2.0cm taller on average than their mothers
4. A distinguishing characteristic of the duckbilled platypus is the fact that, while it is classified as a mammal, it nevertheless lays eggs and incubates them externally
5. A simple laboratory test for oxygen, the Winkler test, involves the use of manganous chloride and potassium hydroxide.

13. Fish obtain oxygen by means of gills. Oxygen dissolved in the water outside diffuses through the gill membrane. The general equation for the rate of diffusion through a membrane at a given temperature can be written

$$R = \frac{A \times C}{D} \text{ per unit of time}$$

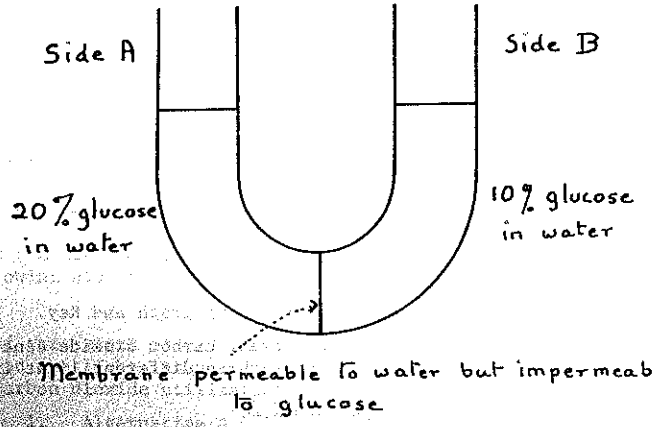
where R is the rate of diffusion across the membrane
A is the area of the membrane
C is the difference in concentrations of the diffusing substance on either side of the membrane
D is the thickness of the membrane.

A fish will obtain oxygen most rapidly if the

1. gill membrane is thick; its area is small and there is only a small difference between the concentrations of oxygen on either side of the membrane
2. gill membrane is thin; its area is large and there is a large difference in dissolved gases on either side of the membrane
3. gill membrane is thin; its area is large; there is a large difference in the concentrations of oxygen on either side of the membrane and the concentration of oxygen outside the membrane is greater than the concentration of oxygen inside the gill capillaries
4. gill membrane is thin; its area is large; there is a large difference between the concentrations of oxygen on either side of the membrane and the concentration of oxygen outside the membrane is less than the concentration of oxygen inside the gill capillaries.

SEE PAGE 7

Questions 14 & 15 are based on the following data.



At the beginning of the experiment, the solutions in the two arms of the tube are as pictured. The apparatus is allowed to stand for several days.

14. The glucose solution of side A will

1. become more concentrated and that on side B will become less concentrated, since water moves from A to B
2. become more concentrated and that on side B will become less concentrated since water passes from B to A
3. become less concentrated and that on side B will become more concentrated since water passes from A to B
4. become less concentrated and that on side B will become more concentrated since water passes from B to A.

15. Osmotic potential is the tendency to gain H_2O by osmosis. Osmotic potential will be greatest on

1. side B at the beginning of the experiment
2. side B at the end of the experiment
3. side A at the beginning of the experiment
4. side A at the end of the experiment.

SEE PAGE 8

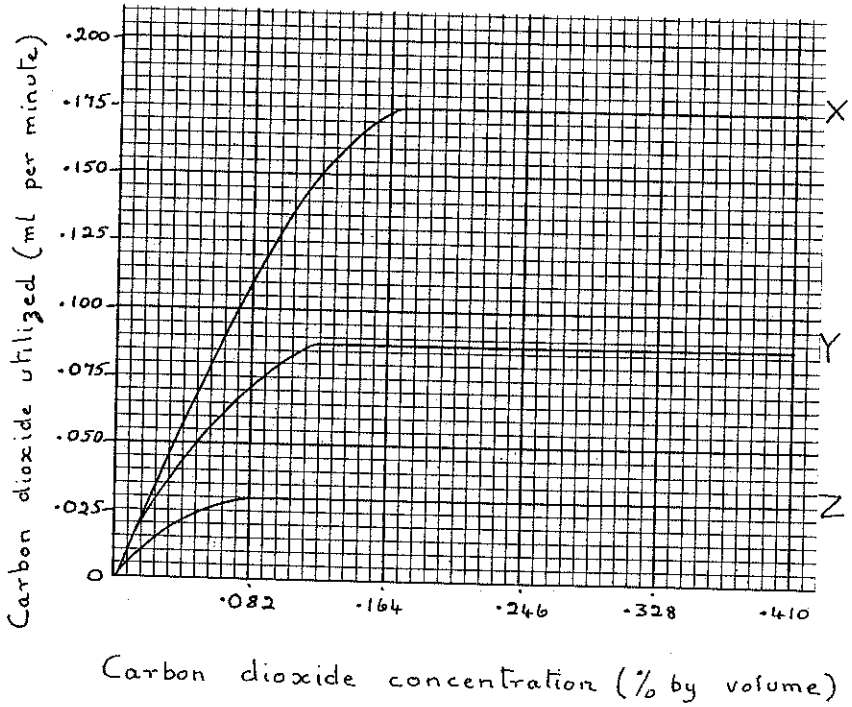
16. Which of the following statements best accounts for ecological succession?

1. Organisms can change both their living and non living environments
2. Organisms can change their living environment but not their non living environment
3. Organisms can change their non living environment but not their living environment
4. Species of organisms themselves change to meet the demands of the environment.

Questions 17, 18 & 19 are based on the following graph and Key.

The graph shows the relation between different carbon dioxide concentrations and the rate of photosynthesis in wheat at three different light intensities.

X at 947 foot candles
Y at 630 foot candles
Z at 156 foot candles



SEE PAGE 9

KEY

A. The statement is true according to the graphs.
B. The statement is false according to the graphs.
C. The statement cannot be judged by the graphs, but is in accord with an established biological principle.
D. The statement cannot be judged by the graphs and is not in accord with an established biological principle.
E. The statement cannot be judged by the graphs or by an established biological principle.

Which of the alternatives in the Key is the most appropriate description of the following statements?

17. If the amount of carbon dioxide is decreased from .123% by volume and the light intensity held constant, there is an increase in carbon dioxide utilization.

1. Alternative A
2. Alternative B
3. Alternative C
4. Alternative D
5. Alternative E.

18. The carbon dioxide content of the air over a field of green wheat (that is, in the layer of air next to the wheat) on a warm still summer day would be less in daytime than on a still warm night.

1. Alternative A
2. Alternative B
3. Alternative C
4. Alternative D
5. Alternative E.

19. Water does NOT influence the rate at which carbon dioxide is utilized per minute.

1. Alternative A
2. Alternative B
3. Alternative C
4. Alternative D
5. Alternative E.

SEE PAGE 10

Questions 20, 21 & 22 are based on the following table. (Hint: fill in the blank spaces before answering the questions)

	ORGANISM I	ORGANISM II	ORGANISM III	ORGANISM IV
PHYLUM	Arthropoda			
CLASS	Hexapoda			
ORDER	Lepidoptera	Lepidoptera		
FAMILY	Tortricidae	Psychidae		Tortricidae
GENUS	Archips	Solenobia	Archips	Eulia
SPECIES	rosano	walshella	fervidona	pinatubana

20. Which organism(s) belong(s) to the class Hexapoda?

1. I
2. I and III
3. I, II, and IV
4. I, II, III and IV.

21. Which two organisms are most similar?

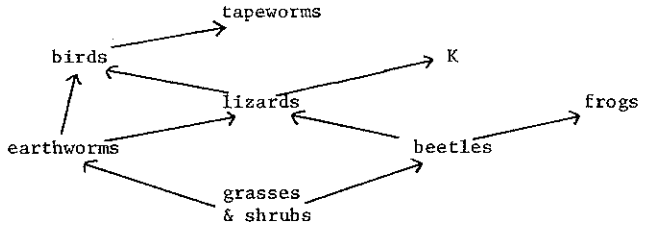
1. I and II
2. I and III
3. I and IV
4. II and III

22. Which organism is the most distantly related to organism IV?

1. I
2. II
3. III
4. All are equally related.

SEE PAGE 11

Questions 23-26 are based on the following food web.



23. Which one of the following could not occupy position K in the food web?

1. a tick
2. a fungus
3. a microorganism
4. an autotroph.

24. What is likely to be the first observable change in the food web if most of the earthworms die?

1. An increase in the number of lizards
2. A decrease in the number of frogs
3. A decrease in the number of birds
4. An increase in the number of beetles.

25. Which one of the following would probably be least numerous?

1. Lizards
2. Beetles
3. Birds
4. Earthworms.

26. Along which food chain would the greatest loss of energy from the food web occur?

1. Grasses & shrubs → beetles
2. Grasses & shrubs → earthworms → birds
3. Grasses & shrubs → beetles → lizards
4. Grasses & shrubs → beetles → frogs
5. Grasses & shrubs → earthworms → lizards → birds.

SEE PAGE 12

Questions 27 & 28 are based on the following information.

27. Dodder is a parasitic plant that twines around other plants and obtains nourishment from them through tube-like outgrowths from the stem. If it is living on a long-day plant such as Calendula, it will flower only when the days are long as does its host. If it is living on a short-day plant, such as Cosmos, it will flower only when the days are short as does the Cosmos. From the foregoing evidence, it can be tentatively concluded that the dodder

1. is a long-day plant
2. is a short-day plant
3. determines whether its host will be a long-day or short-day plant
4. has no stimulative effect on its host.

28. The evidence further suggests that

1. parasites usually destroy their host
2. enzymes pass from host to parasite
3. adjustment to a given day-length is fixed for all plants - a plant is either a long-day or a short-day plant.
4. a hormone produced in one plant can effect a change in another plant
5. the dodder is a wide menance to West Australian pot plants.

29. The lenses of a monocular microscope had the following magnifications:

ocular: 10 times
low power objective: 10 times
high power objective: 40 times

If a cell was firstly viewed under low power, then viewed under high power, which of the following is correct?
The cell would appear to be

1. 400 times larger
2. 4 times smaller
3. 40 times smaller
4. 4 times larger
5. ¼ the size.

SEE PAGE 13

Questions 30 & 31 are based on work done by English biologists interested in the possibility that nematode-trapping fungi which are widely distributed in soil could be used to control parasitic nematodes.

A field of oats already infested with parasitic nematodes was divided into four plots. Each was given a different treatment as shown in the table below. Then sample plants, chosen at random, were dug up and the numbers of nematodes in their roots were counted. The roots of the sample plants were weighed and the table shows the mean number of nematodes per gram of root for each plot.

	TREATMENT	Average No. of nematodes per gram of root
I	Living fungus with chopped cabbage leaves added to soil	127
II	Living fungus only added to soil	154
III	Cooked fungus with chopped cabbage leaves added to soil	370
IV	Cooked fungus only added to soil	408

30. How are the figures for the average number of nematodes per gram of root related to the density of the population of parasitic nematodes?

1. They are a useful measure of the density of the population
2. They could be used to calculate the size of the population if the number of plants/unit area were known
3. They cannot be used to calculate the density of the population because nematodes would be unevenly spread through the plots
4. They are a measure of the severity of the disease and not of the density of parasitic nematodes.

31. Which of the following explain the effect of adding chopped cabbage leaves? Chopped cabbage

1. inhibited the growth of added fungi only
2. stimulated the growth of added fungi only
3. inhibited the growth of fungi already present
4. stimulated the growth of fungi already present.

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Questions 32 & 33 are based on the following Key.

KEY

A Isolation
B Genetic drift
C Gene mutation
D Genetic recombination
E Natural selection.

From the key, select the term which is best defined in questions 32 & 33.

32. A factor which operates to eliminate individuals less adapted than their competitors in a given environment.

1. Term A
2. Term B
3. Term C
4. Term D
5. Term E

33. A possible source of variation which, in many cases, may not be evident phenotypically unless present in enough individuals of a population so that it can become homozygous.

1. Term A
2. Term B
3. Term C
4. Term D
5. Term E

34. As a result of mitosis the daughter cells have, when compared with the parent cell

1. double the number of chromosomes with the same kind of chromosomes and the same kind of genes
2. one half the original number of chromosomes with the same kind of chromosomes and the same kind of genes
3. one half the original number of chromosomes and each cell has one half the original kind of chromosomes and one half the original kind of genes
4. the same number and the same kind of chromosomes and the same kind of genes
5. double the number of chromosomes with one half the original kind of genes.

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35. At some point in the life cycle of organisms which reproduce sexually the diploid number of chromosomes must be reduced to the haploid number. This is because

1. the number of chromosomes would otherwise double in each generation
2. mitosis cannot take place without such a reduction occurring
3. the sperm cell must have the same number of chromosomes as other body cells
4. all body cells have the same number of chromosomes
5. a change in the number of chromosomes in the body cells of an organism can only occur as the result of mutation.

Questions 36 & 37 are based on the following information.

At the beginning of 1938 a country had a population of 7 000 000. During that year the birthrate was 17 per thousand, the death rate was 9, the immigration rate was 2 and the emigration rate was 1.

36. What was the rate of growth of the population in 1938?

1. 8 per thousand
2. 9 per thousand
3. 11 per thousand
4. 23 per thousand.

37. What would the population be at the end of 1938?

1. 7 021 000
2. 7 059 000
3. 7 060 000
4. 7 063 000

38. A scientist went into a village whose population was evenly divided between natives of the village and a group of immigrants. He was testing a serum which was supposed to protect against a particular disease so he gave the serum to the natives and nothing to the immigrants and later compared the number of cases of the disease in each group. This procedure could have been improved by which one of the following designs?

1. Inject the natives with the full amount of serum and inject the immigrants with half the amount of serum and compare results.
2. Inject the natives with serum and half the immigrants with serum and compare results.
3. Inject the natives with serum and inject the immigrants with a harmless inactive solution so the psychological reaction is eliminated.
4. Inject half the natives with serum, the other half with a harmless, inactive solution and inject half the immigrants with serum and the other half with a harmless, inactive solution and compare results.
5. Because the experiment involves human subjects there is no way in which the design could be improved.

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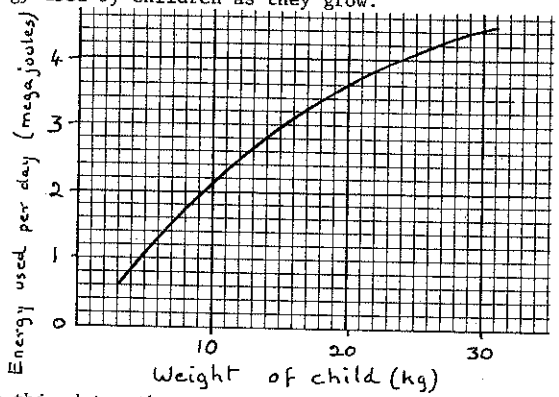
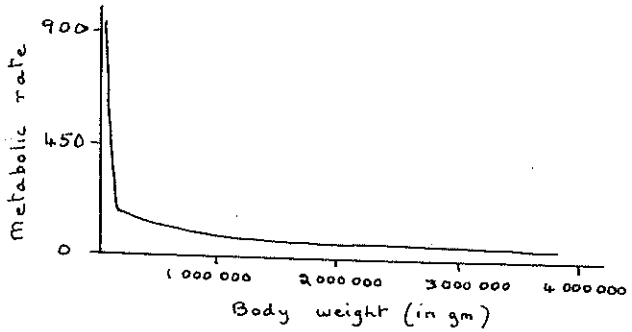
39. The graph shows measurements made of the average amount of basal energy used by children as they grow.



From this data, the energy needed per kilogram of body weight for a 15 kilogram child is most likely to be

1. 15 megajoules
2. 3 megajoules
3. 2 megajoules
4. 0.2 megajoules.

40. The graph below represents the relationship of metabolic rate and body size in mammals. (Metabolic rate is given in cubic millimetres of O_2 per gram of body weight per hour.)



From the above graph it can be predicted that

1. elephants should have a high metabolic rate
2. mice should have a low metabolic rate
3. mammals weighing less than 100 000 grams should be extremely active
4. mammals with a large surface area-to-volume ratio should have a low metabolic rate.

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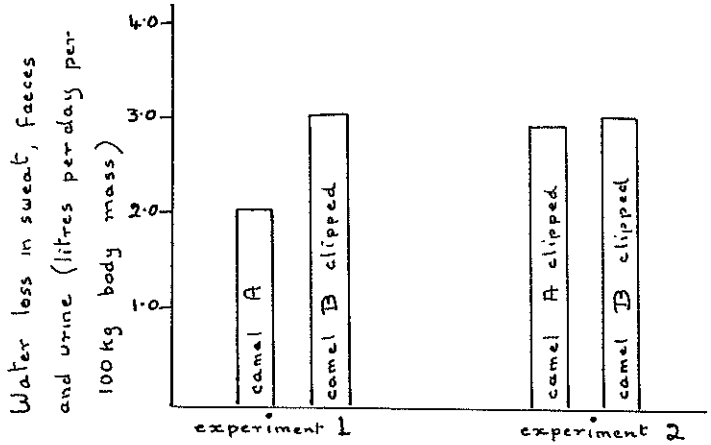
SECTION B

Suggested time: 75 minutes (36 marks)

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

41. *(6 marks)*

The dromedary camel grows a dense fur coat in both summer and winter. In experiments to determine the means by which the animal controls its body temperature, the body water loss of two camels of different size was measured. Before the first experiment, camel B was shorn while A retained its woolly coat. Before the second experiment both animals were shorn. The results are shown on the following diagram.



(a) Compare the water loss between the two animals in experiment 1 and between the two animals in experiment 2 and explain how these results can be used as evidence in assessing the effect of fur on body water loss.

(b) Camel A weighed about 250 kg; camel B weighed about 500 kg. In experiment 1 how much more water did camel B lose per day than camel A?

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42. *(10 marks)*

Aquatic organisms take in and give out certain gases in solution. Fish, for example, depend on oxygen dissolved in water and not, incidentally, on the oxygen of the water molecule (H_2O). Water has the ability to absorb certain gases and this is sometimes expressed as an absorption coefficient. It is defined as the volume of gas dissolved in one volume of water at 0^oC and under a pressure of one atmosphere. For example, if a gas had an absorption coefficient of 1.0, then 1.0 cm^3 of water could contain a maximum of 1.0 cm^3 of the gas.

In table 1 absorption coefficients are given for carbon dioxide, oxygen, and nitrogen at different temperatures. Examine the figures carefully and relate them to the lives of organisms in a pond or aquarium.

Temperature (^oC)	Absorption coefficients		
	carbon dioxide	oxygen	nitrogen
0	1.71	0.048	0.023
10	1.19	0.038	0.019
20	0.87	0.031	0.016
30	0.66	0.026	0.013
40	0.53	0.023	0.011

(a) Plot the data on the graph paper provided.

(b) What does the data tell us about the amount of the gases dissolved in water at different temperatures?

(c) Which of the gases in table 1 are

i) taken in by plants in the light?

ii) given off by plants in the dark?

iii) taken in by animals in the dark?

iv) given off by animals in the light?

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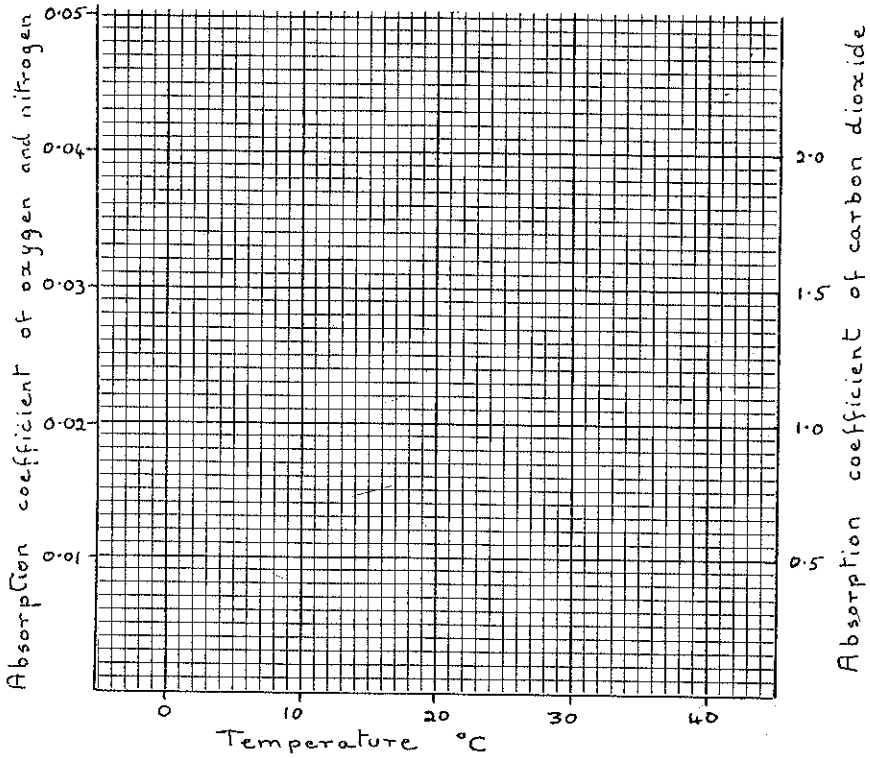

[If you spoil this graph, write "see page 40" across it and use the graph paper on page 40].

(d) Based on your knowledge of the relation of temperature to activity in animals and on the information in the graph, how would you expect an increase in water temperature over several months to affect the activity of a well fed goldfish kept in a large jar of water?

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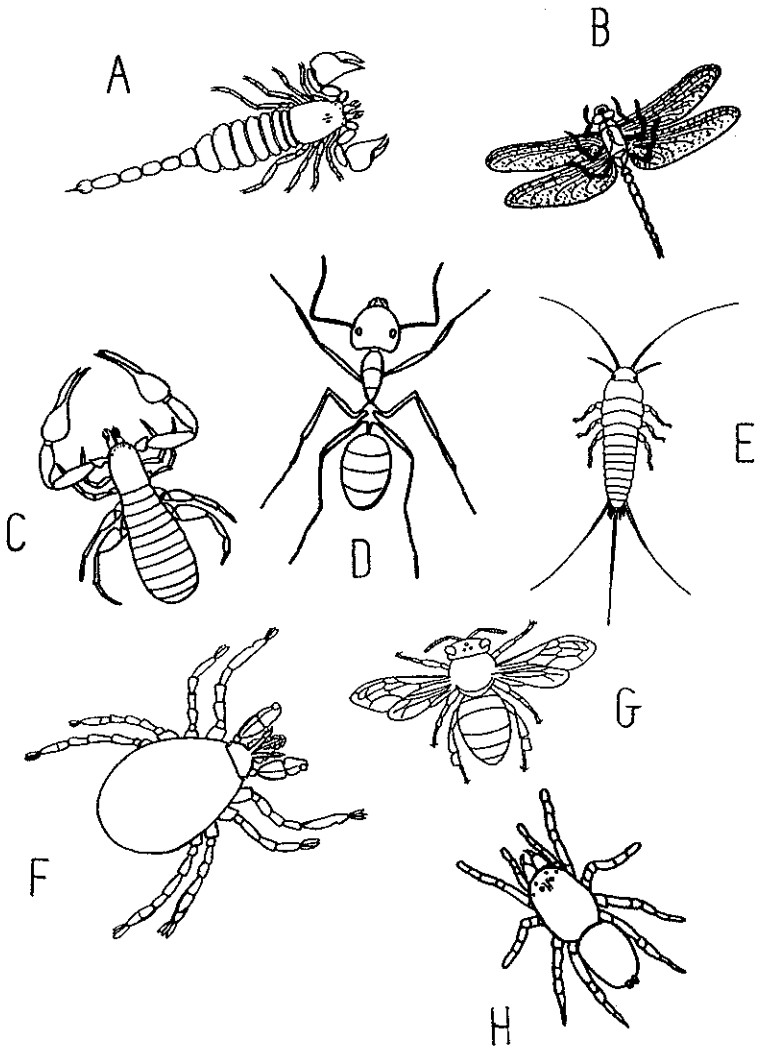
43. *(7 marks)*



Construct a dichotomous key for the above animals.

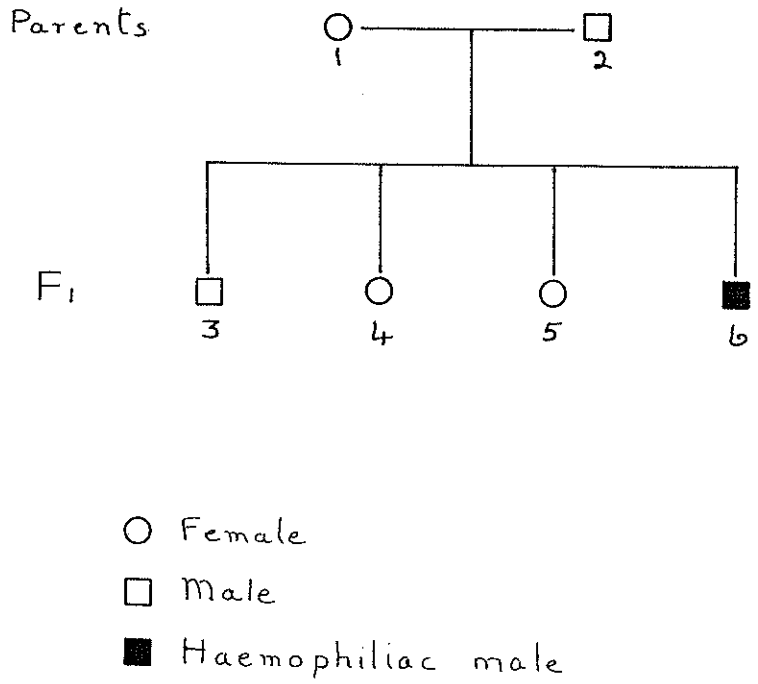
SEE PAGE 21.

43. *(continued)*

SEE PAGE 22

44. *(6 marks)*

In man, a recessive sex-linked gene (b) prolongs the blood-clotting time, resulting in what is commonly called "bleeder's disease" or haemophilia. From the information given in the pedigree, answer the questions listed below.



(a) What is the chance of female 4 being a carrier?

SEE PAGE 23

44. *(continued)*

(b) If female 4 is a carrier and marries a normal man, what is the chance of her first child being a haemophiliac? Show how you obtained your answer.

(c) For the parents in (b) above, what is the chance that their second child is a haemophiliac?

(d) If we do not know whether female 4 is a carrier or not, what is the chance that her first child will be a haemophiliac? Show how you obtained your answer.

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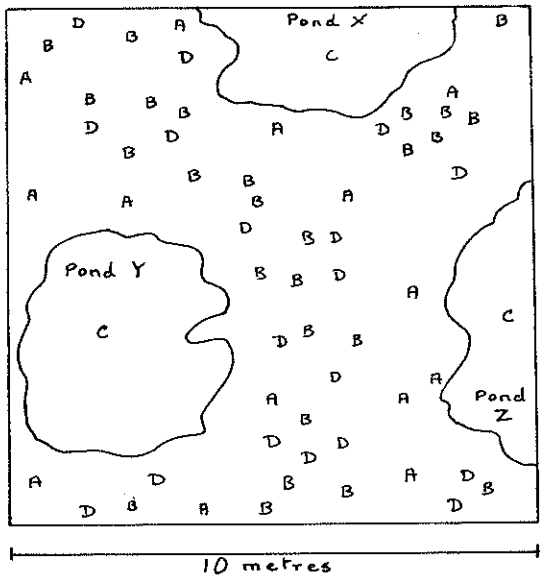
45. *(7 marks)*

The diagram shows the distribution of four species of plants A, B, C and D in an area.



(a) In order to carry out a vegetation survey of the above area it will be necessary to use a method of sampling. If you were given quadrats (square metal frames similar to picture frames) with sides each measuring 25cm, how would you arrange to distribute ten of them at random in the area?

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(b) Are any of the species in the above diagram distributed at random? Explain your answer.

(c) One of the problems incurred when using quadrats is to select the best size. Outline THREE considerations you must bear in mind in any situation when deciding how large the quadrats should be.

(d) In which of the following situations would the quadrat method of sampling NOT be suitable? Explain your answer.

i) A flight of birds

ii) An open heathland

iii) A grassy meadow

iv) A tropical rainforest

v) A plague of adult grasshoppers.

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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) In your biology course you will naturally have carried out environmental investigations. From your personal experience what would you do if you were asked to produce an environmental impact statement on ONE of the following areas?

An environmental impact statement involves investigating the ecological aspects of the area before disturbance and then predicting possible changes (in conjunction with laboratory experiments) that might result.

(i) An area to be mined for beach sands. This area has an offshore reef bounded by deep sheltered water which is now a harbour. On the landward side of the beach there is a dune system backed by agricultural land.

(ii) A granite outcrop in a jarrah-banksia forest which is to be turned into a quarry.

(iii) An area of woodland and low scrub on the edge of a sand plain. This area is to be used for open cut mining for precious metal.

OR

(b) Many land mammals in arid areas can be found during the day in burrows, hollow logs, or rocky outcrops. At night they become active.

Choose a mammal which exhibits this behaviour and discuss how this behaviour pattern and the animal's physiological adaptations allow it to survive in this environment.

SEE PAGE 27

46 (continued)

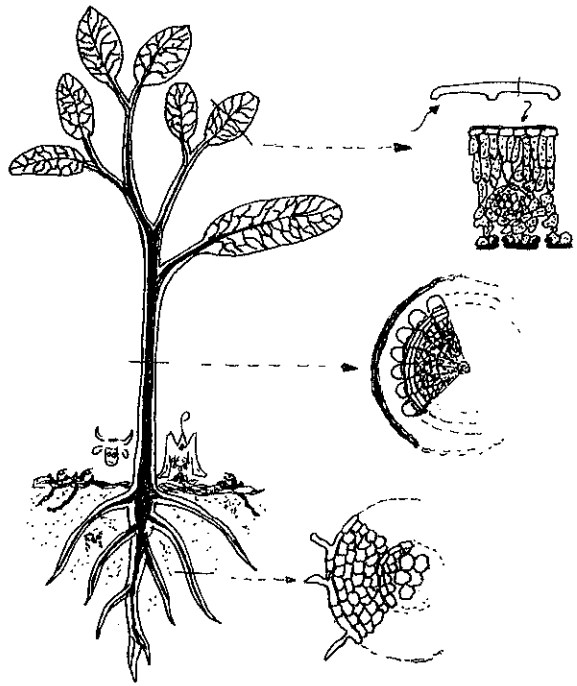
OR

(c) "A multicellular plant is not merely a collection or an aggregation of cells of similar structure and function."

Discuss this statement making use of examples to support your points.

In your answer you should cover the following areas:

entry of water and solutes
transport system
food manufacture, use and storage.



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47. EITHER

(a) Describe how changes in an environmental factor can bring about changes in a species of organism over a long period of time. Give an example, real or imaginary. If such radical changes have taken place in a species of organism could you decide whether it was still the same species as it was several thousand years ago? Give your reasons.

OR

(b) The farming industry in Australia has to keep a very close watch on parasitic infections in domestic animals. Some of these parasites can also infect man.

(i) What is an adaptation?

(ii) In what ways are parasites adapted to life within a host? Select one specific example as an illustration of your answer.

(iii) How is your chosen parasite adapted to survive transfer from one host to another?

(iv) Parasites rarely kill their normal host but can be lethal if infecting the wrong host, e.g. Man. Explain this fact.

(v) Discuss the methods by which Man controls your chosen parasite.

OR

(c) Animal cells carry out metabolism by means of the coordinated activity of all of their organelles.

Draw a generalised animal cell and carefully label each organelle.

Explain the part played in cell metabolism by each of these components.

END OF PAPER