WESTERN AUSTRALL.

TERTIARY ADMISSIONS EXAMINATION

1980

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 39 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				46 a		
	41				46 b		
	42				46 c		
B	43			C	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 39 which is folded into the back of this paper.

Write your number in the box at the top of page 39 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.

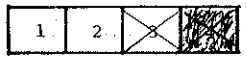
You MUST NOT take this question paper away from the examination room.

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 39). 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 4 above.

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

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

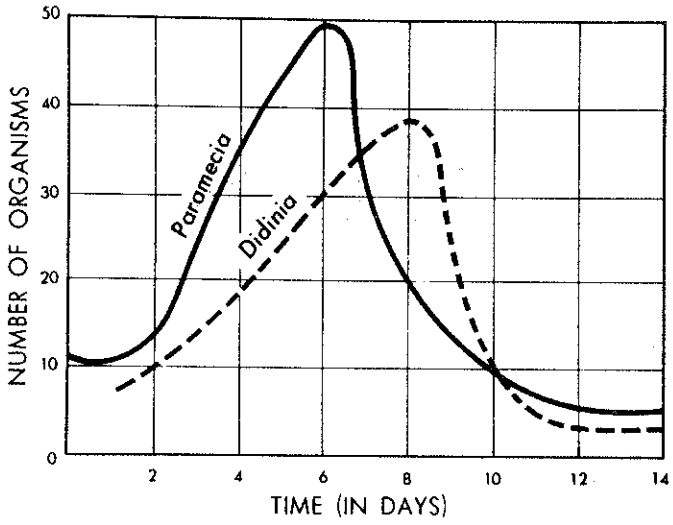
    1. synthesis of protein
    2. contraction of muscle
    3. diffusion of sodium chloride
    4. active transport.

2. A human organism grows from a zygote to a foetus by the process of

    1. gastrulation
    2. mitosis
    3. fertilisation
    4. differentiation.

SEE PAGE 4

Questions 3 - 6 are based upon the following.



Paramecia were placed in a jar containing nutrient material. A day later, Didinia, protozoans which feed upon Paramecia, began to appear in the culture. They came from spores in the air. The growth curves shown in the chart above were obtained by making daily determinations of the numbers of living organisms of both types.

3. The total number of living organisms in the jar had <u>decreased</u> most rapidly between days

   1. 2 and 6
   2. 4 and 8
   3. 6 and 10
   4. 10 and 14.

4. The time at which the <u>least</u> total number of living organisms was present in the jar was day

   1. 1
   2. 7
   3. 10
   4. 14.

SEE PAGE 5

5. The initial rapid increase in the growth rate of the Didinia can be explained by the fact that

   1. they are becoming accustomed to their new habitat
   2. their food supply was increasing and therefore they were increasing in number
   3. the nutrient material available to the Paramecia was rapidly becoming exhausted
   4. their food supply was decreasing and they were reproducing more rapidly as a response to unfavourable conditions.

6. At which stage is there a balance between birth rate and death rate for the Didinia?

   1. day 1
   2. day 6
   3. day 8
   4. day 10.

7. In which of the following processes does the energy source come from outside a green plant?

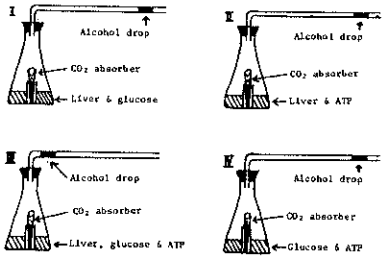
   1. respiration
   2. starch synthesis
   3. photosynthesis
   4. protein synthesis.

8. Ferns rank higher than mosses in the plant kingdom because they

   1. are the dominant land plants today
   2. are larger plants
   3. have a vascular system
   4. have alternation of generations.

SEE PAGE 6

Questions 9-11 are based on an experiment in which equal amounts of ground up liver cells, with the ATP removed, are placed in respirometers I, II and III. Flask I contains glucose. ATP is added to flask II. Flask III contains a glucose solution and ATP. Flask IV contains no liver - only glucose and ATP. All flasks are placed in a water bath at 20^{0}C. The following figures represent the respirometers after one hour.



9. Which is the best interpretation from these data?

   1. ATP and glucose interact to produce CO_2
   2. ATP is necessary to start the respiratory breakdown of glucose
   3. respiration cannot take place outside of living cells
   4. the Krebs cycle is not operating since no ATP is given off.

10. What is the main function of flask No. IV?

   1. to measure gas changes due to temperature changes
   2. to measure gas changes due to temperature and air pressure changes
   3. to control changes in gas pressures
   4. to determine how glucose and ATP function.

11. The reaction in flask III stops after two hours. What is the most likely explanation?

   1. all the glucose is used up
   2. all the ATP is used up
   3. all the CO_2 is used up
   4. enzymes cannot function outside of living cells.

SEE PAGE 7

12. Congestion of the lungs occurring in certain diseases stops the blood circulation through the lungs. One would expect to find on examination after death that

   1. the left ventricle is swollen with blood
   2. both atria are collapsed
   3. the right atrium and right ventricle are swollen with blood
   4. both ventricles have emptied of blood.

13. Which one of the following is the end product of protein digestion?

   1. amino acids
   2. urea
   3. glycogen
   4. carbohydrates.

14. The concentration of ions of potassium found in the cells of the freshwater alga *Nitella* is many times that of the water this plant inhabits. The absorption of potassium is therefore achieved by

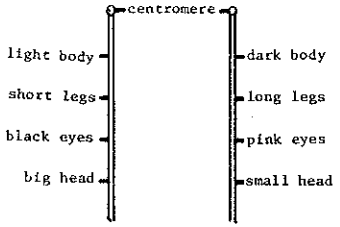
   1. osmosis
   2. active transport
   3. pinocytosis
   4. diffusion.

15. Toadstools growing in a lawn mainly obtain their nutrients by

   1. absorbing inorganic fertilizers applied to the lawn
   2. digesting humus derived from dead foliage of the lawn grass
   3. parasitising the living lawn grass
   4. absorbing ions of salts from the soil beneath the lawn.

SEE PAGE 8

Questions 16 and 17 are based on the following map of a beetle's chromosomes.



16. Crossing-over would probably be most frequent between loci of genes

    1. eyes and legs
    2. body and legs
    3. eyes and head
    4. body and head.

17. Assume crossing-over between dark body and pink eyes was expected to be 50% yet experimental results were only 42%. Which best explains this?

    1. the traits are not always linked
    2. double cross-over occurred
    3. dark body is dominant over pink eyes
    4. cross-over between body and eyes already occurred.

18. The regulation of the internal environment of an organism to maintain it in a stable state is called

    1. homeostasis
    2. excretion
    3. osmoregulation
    4. metabolism.

SEE PAGE 9

19. Which of the following helps explain why some harmful mutations are not eliminated from the gene pool of a particular population?

    1. they may have future survival value, and are retained
    2. they are dominant and can prevent their removal
    3. they are recessive and are carried by heterozygotes
    4. because genetic drift occurs.

20. Certain termites eat wood, but have no enzymes capable of digesting it. Protozoa living in the termite's gut digest the wood. Without each other both organisms could not survive. This relationship is known as

    1. parasitism
    2. botulism
    3. commensalism
    4. mutualism

21. In which of the following situations is there <u>least</u> chance of observing succession of biological communities?

    1. a mature Eucalypt forest community in equilibrium with its environment
    2. a freshwater pond which has filled after a dry summer
    3. an area in which the scrub vegetation has been burned in a bush fire
    4. a small island following a volcanic eruption.

22. In plants, which of the following contains the greatest amount of nitrogen?

    1. cell walls
    2. enzymes
    3. sucrose
    4. starch grains.

SEE PAGE 10

Questions 23, 24 and 25 are based on the paragraph below.

Using a monocular microscope, a biologist found that when the 40X objective is in position, the diameter of the field of view is approximately 0.30 mm. Counting left to right, she observed 15 rectangular onion cells across the field of view when using high power magnification (40X). Also, counting from top to bottom she observed that 5 cells spanned the diameter of the field of view.

23. What is the best estimate of the average width of the onion cells?

1. 0.01 mm
2. 0.02 mm
3. 0.03 mm
4. 0.04 mm.

24. What is the best estimate of the average length of the onion cells?

1. 0.02 mm
2. 0.04 mm
3. 0.06 mm
4. 0.08 mm.

25. How many cells, counting from bottom to top, would she observe when using a 10X objective?

1. 1.25
2. 5
3. 10
4. 20.

26. Scientists of all nations use scientific names for organisms because these names

1. are easily understood
2. are the same everywhere
3. are easier to write
4. consist of two words.

SEE PAGE 11

27. Which of the following would NOT be an adaptation for plants living in low rainfall areas?

1. hairy leaves
2. short life cycle
3. very small leaves
4. many stomates.

28. One can not refute the Theory of Special Creation (that life was a result of some supernatural power) because it

1. is illogical
2. can not be tested experimentally
3. would be too difficult
4. has been proved correct.

29. Which one of the following best describes the function of root hairs? They:

1. add to the length of the root by repeated cell division
2. provide anchorage for the root
3. protect the delicate surface cells of the elongating root
4. provide a large surface area for absorption.

30. *Amoeba* is a small freshwater protozoan. It has a large surface area to volume ratio which is an advantage because it

1. allows greater increases in size
2. prevents rapid temperature changes
3. permits rapid diffusion
4. increases the rate of mitosis.

SEE PAGE 12

31. A theatre audience applauds during a performance. Within a few seconds the room feels warmer to an observer (who did not clap) in the crowd. Which of the following is a probable reason for the observer's feelings?

    1. the rubbing of the hands caused large quantities of heat by friction
    2. the applause stimulated the observer and his metabolic rate rose
    3. muscle activity produced large quantities of heat
    4. ATP is produced when people clap.

Questions 32 and 33 are based on the following data.

In humans, identical twins occur in about 1 in 300 births. Red hair is not sex-linked, and is recessive to dark hair.

32. What is the probability of a dark-haired couple having a red-haired child if each had a red-haired parent?

    1. 0.25
    2. 0.50
    3. 0.75
    4. 1.00

33. What is the chance of the same couple having identical, red-haired twins?

    1. 1 in 300
    2. 1 in 600
    3. 1 in 1200
    4. 1 in 2400

34. The chemical which controls the normal rhythm of breathing in a person at rest is

    1. carbon dioxide
    2. thyroxin
    3. oxygen
    4. A.T.P.

SEE PAGE 13

35. A dog was kept in a room at a temperature of 40°C for two weeks. At the end of that time, it was determined that the dog was sterile. The investigator proposed the hypothesis that the high temperature had caused the animal's sterility. In order to defend the hypothesis, the investigator should be able to show that

    1. the dog was homozygous for temperature sensitivity
    2. the high temperature did not alter the dog's blood pressure
    3. the dog was not sterile before the experimental period began
    4. a cat kept in the same room did not become sterile.

36. An immature male chicken was given injections of a hormone. Two weeks after the beginning of the treatment there was a premature development of adult male sexual characteristics in the bird. From where is the hormone likely to have been extracted?

    1. testes
    2. ovaries
    3. thyroid gland
    4. adrenal glands.

37. Many insecticides kill insects by

    1. soaking through the exoskeleton
    2. entering the lungs via the mouth
    3. entering via the spiracles
    4. entering the stomates.

38. Mxyomatosis is a virus which has been responsible for eradication of vast numbers of rabbits in Western Australia. The virus is transmitted from one rabbit to another by a mosquito. In relation to the virus the mosquito is a

    1. parasite
    2. vector
    3. saprophyte
    4. predator.

SEE PAGE 14

39. An animal species survives in a particular environment because of a certain feature. This best describes

1. a mutation
2. natural selection
3. evolution
4. an adaptation.

40. "Year after year, men cutting timber or hunting deer in the Blue Mountains of eastern Oregon had come back with the same story. Near the little hamlet of Kamela, they had often heard a faraway tinkling, a ghostly bell ringing. No one was ever able to track down the strange sound. It would fade away in the sighs of the wind through the big pines. Sceptics accused the men of hearing things.

"Last week, slashing a right-of-way for a power line from Bonneville Dam, lumberjacks brought down a ponderosa pine. Tied by a shriveled leather thong, high in the treetop was the answer to the mystery of Kamela: a bronze cattle bell, inscribed with the date 1878 ..... . The people of Kamela guessed that a pioneer had tied it to a sapling that grew into a towering pine." (TIME Magazine).

Which of the following is the best appraisal of the concluding sentence in this report?

1. logical - because this particular tree elongates from the ground up
2. logical - because this particular tree could have attained great height since 1878
3. illogical - because no one knows with certainty when the bell was tied to the sapling
4. illogical - because elongation occurs only in the region of the growing point of the shoot.

SEE PAGE 15

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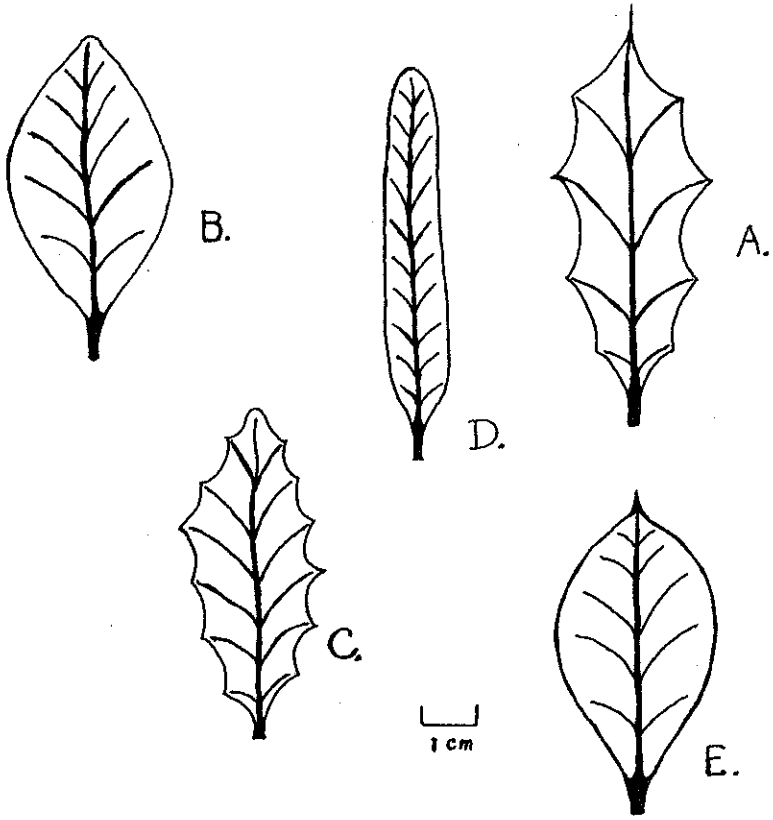
SEE PAGE 16

SECTION B

Suggested time: 75 minutes (36 marks)

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

41. (4 marks)



Construct a dichotomous key for the above leaves. (Use page opposite).

SEE PAGE 17

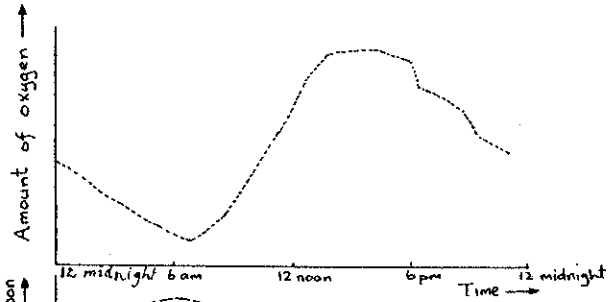
41. (*continued*)

SEE PAGE 18

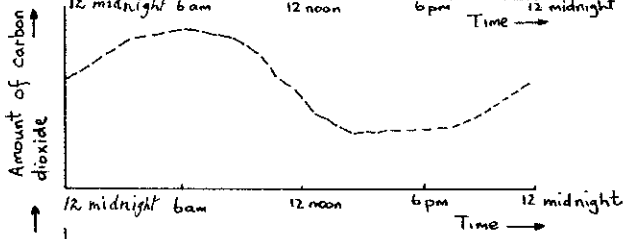
42. (7 marks)

The graphs below show changes recorded in the temperature, amount of carbon dioxide, and amount of oxygen in a river during a period of 24 hours. The river contains an abundance of plant and animal life.

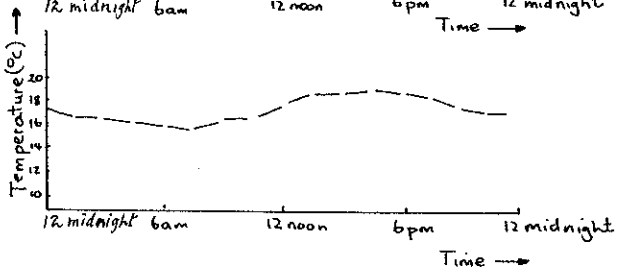
GRAPH A



GRAPH B



GRAPH C



Note: Units for oxygen and carbon dioxide have been intentionally left off the graphs for the sake of simplifying the question.

(a) Describe the trends in the amounts of oxygen and carbon dioxide between 6.00 a.m. and 6.00 p.m.

SEE PAGE 19

42. *(continued)*

(b) How do you explain the changes over time in the amounts of oxygen and carbon dioxide in graphs A and B?

(c) Graph C shows that there is a very small change in temperature during the 24 hour period. How does this affect your interpretation of the reasons for the changes in graphs A and B?

SEE PAGE 20

43. (10 marks)

The water hyacinth *(Eichhornia crassipes)* is a floating flowering plant native to rivers of South America. It has become naturalised in many parts of Australia since the 1930's, where it infests swamps, drainage channels and backwaters of rivers to the detriment of native flora and fauna.

In some parts of southern Australia *Eichhornia* has been successfully controlled by improving drainage and by using herbicides, but the threat of further infestations remains from the northern Australian populations and from plants discarded from garden ponds. Furthermore, due to the extensive infestations of this weed in the warmer areas of northern Australia, eradication by such control methods would now be impossible.

In 1975 the Commonwealth Scientific Industrial Research Organisation (CSIRO) imported a South American weevil called *Neochetina eichhorniae* from Florida, U.S.A. This insect was known to feed exclusively on water hyacinth. The CSIRO researchers' studies of the feeding habits of this weevil, carried out under quarantine conditions, confirmed the American experience that the weevil confines its attack to water hyacinth.

After release, the weevils became established in areas of water hyacinth infestations. Within two years a noticable decrease in the water hyacinth population was observed. However, it will be several years before the effectiveness of *Neochetina* as a control agent can be fully assessed.

The researchers do not expect this weevil by itself to satisfactorily control the weed over its whole Australian range. Indeed they expect it will be necessary to test and release a number of insect species.

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43. *(continued)*

(a) What type of control was CSIRO using?

(b) Why were South American weevils imported?

(c) Why were the studies carried out in quarantine?

(d) After it was released in the field why does it take several years to test the effectiveness of *Neochetina* as a control agent?

(e) Why do you think the CSIRO expects it will need to use other insects as controlling agents?

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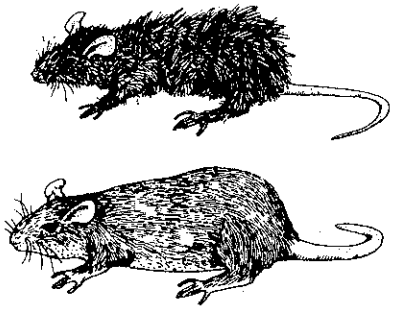

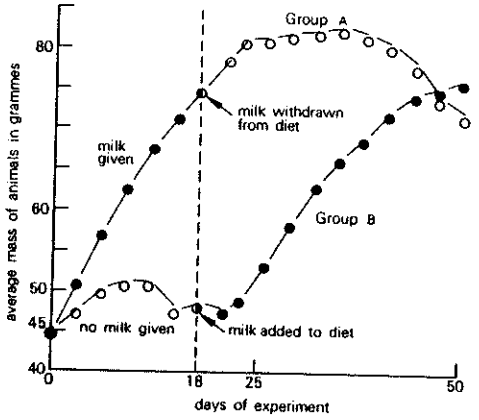

Graph for Question 44.

SEE PAGE 23

44. (7 marks)

The English biochemist Hopkins kept two groups of eight young male rats on a diet consisting of pure protein, starch, sucrose, inorganic salts and water. Group A was given in addition a small daily ration of milk, representing about 4% of the total food eaten. Group B was given exactly the same diet except that they received no milk. After eighteen days the milk was switched from Group A and given to Group B.

(a) Why was it important to carry out this experiment on groups of rats rather than on two individual rats?

(b) Consider Group A alone, and Group B alone. What was the effect of milk and the absence of milk on the growth of the rats in Group A and Group B as revealed by the graph opposite?

(c) Consider the first 18 days of the experiment. Hopkins had two groups of rats, A and B. Because of this he could draw a conclusion from their growth rates that he could not have drawn had he only had Group A. What is this conclusion? Explain.

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45. (8 marks)

Figure 1 shows the maximum time that various air breathing vertebrates can spend under water without coming to the surface for a breath.

Animal	Time (min)
Alligator	120
Duck	15
Penguin	7
Fin Whale	30
Bottlenose Whale	120

Figure 1. Actual Diving Times for Some Vertebrates

In attempting to explain how these animals manage to remain submerged for such long periods without surfacing for oxygen, scientists discovered the following facts.

1. The percentage of body weight due to blood in natural divers is in most cases about twice that of non-divers.

2. The blood of non-divers may carry about one quarter of its own volume of oxygen. For the natural divers, the figure may be as high as one half.

(a) How may fact 1 above help to explain why the animals could remain submerged for such long periods?

(b) How may fact 2 help explain why the animals could remain submerged for such long periods?

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45. *(continued)*

The scientists then made some measurements of the total amount of oxygen available to these animals while diving, and the rate at which they used oxygen when they were resting (breathing air). These are shown in Figure 2 below. Column 3 shows the maximum length of time for which we would expect the animals to remain submerged. It is based on the values in Columns 1 and 2. Column 1 has been divided by Column 2.

Animal	1. Total Oxygen available in the body while diving (cm^3)	2. O_2-Consumption when resting (cm^3 per min)	3. Longest period for which animal could dive if O_2 used at same rate as Column 2 (min)
Alligator	60	4	15
Duck	85	22	3.9
Penguin	270	100	2.7
Fin Whale	3,350,000	200,000	16.5
Bottlenose Whale	109,000	3,000	36.3

Figure 2. Calculated Diving Times for Some Vertebrates.

(c) Compare the values in Figure 2, column 3 with the values in Figure 1. What general difference do you notice?

(d) Comparing Figure 1 and Figure 2, do animals use oxygen at a greater rate while diving or while resting? From the data available in the question, explain your decision.

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SECTION C

Suggested time: 45 minutes

There are 3 alternatives to each question. Choose ONE alternative for 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) One of the simplest of plants is the microscopic, spherical, unicellular alga, *Chlorella*. This plant lives freely dispersed in still freshwater pools. It reproduces by simple division to form spores which escape from the parent cell and grow to form new adult cells. (See Figure 1 below).

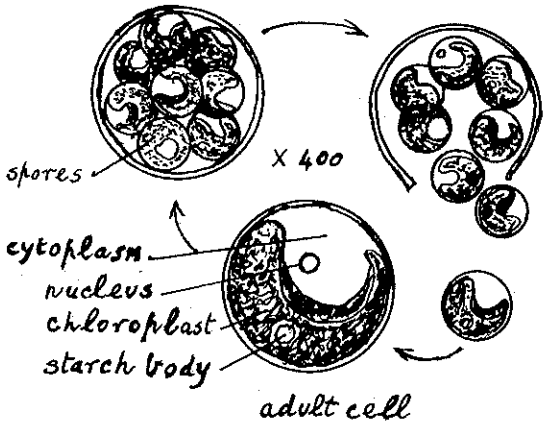

Figure 1.

In contrast to this plant is a complex multicellular *Eucalyptus* tree. (See Figure 2. opposite).

SEE PAGE 27

46. *(continued)*

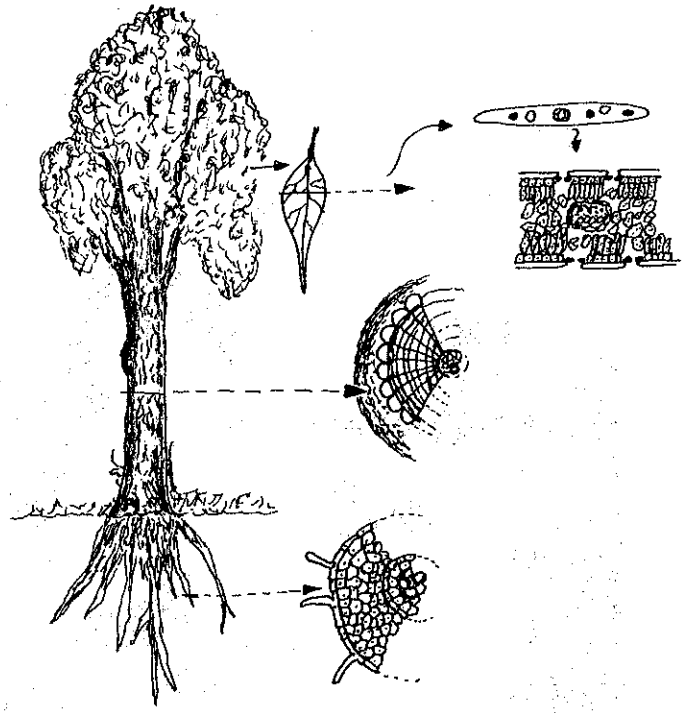

Figure 2.

(i) Compare the methods by which *Chlorella* and a *Eucalyptus* tree obtain their raw materials for maintenance and growth.

(ii) Explain how the products of metabolism in each plant reach the sites where they are needed.

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46. *(continued)*

OR

(b) It is proposed to build a marina on the edge of a shallow inlet adjacent to the Indian Ocean. The inlet is fed by a river which drains the nearby hills. The inlet is the nursery bed for fish, prawns and other crustaceans which breed in the shallow water in a protective cover of algae and other marine plants. It is also used by many people for recreational activities such as fishing, swimming, etc. The inlet is bordered by shelter belts of rushes, paperbarks, etc. The principal organisms of the food web for the area are shown below.

The placid, shallow waters of an undisturbed inlet environment.

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46. *(continued)*

The building of the marina would involve deepening an area of the inlet for boat pens and constructing an access channel to the ocean.

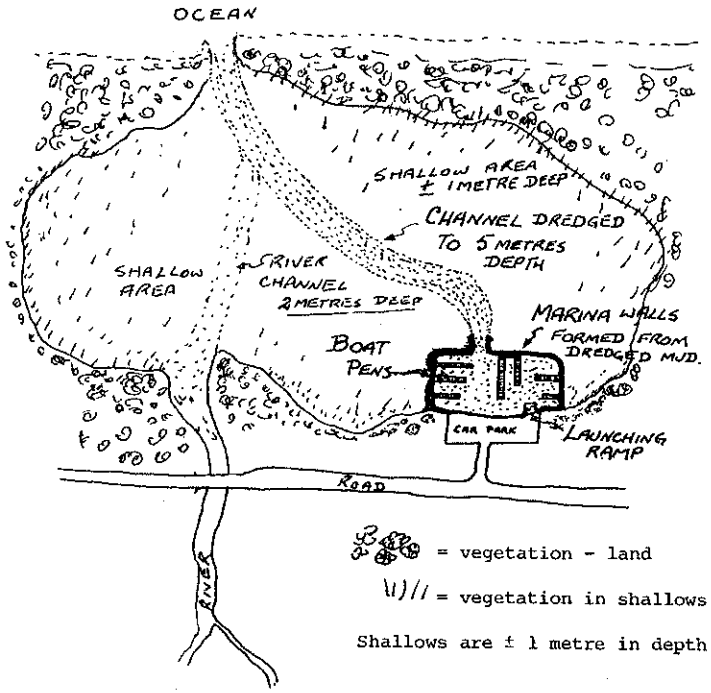

Illustration of the proposed marina development.

Initially there will be a great deal of silt (fine particles of mud) in the water from dredging. Later there will be the stirring action of motor boat propellers. The silt will greatly decrease water clarity and quality.

You are a biologist who is to carry out an investigation into the possible adverse effects of the marina on the ecology of the area.

Explain how the marina may affect the food web of the inlet.

SEE PAGE 30

46. *(continued)*

OR

(c) In the early 1950's, chemicals such as D.D.T. were hailed as the answer to the control of insect pests of crops. Large increases in crop production occurred in some areas following destruction of the insect pests with D.D.T. However, the situation began to change. Over the years farmers found they needed to continually increase the concentration of the spray to control the same insect pests. Experiments showed that many insect species had become resistant to the chemical sprays. The situation has become so serious that massive concentrations are being used. This threatens to permanently damage many ecosystems and even the biosphere.

Explain how these insect species became resistant to the insecticides used to control them, and how chemicals such as D.D.T. have affected ecosystems.

47. EITHER

(a) In South-Western Australia there is a species of ant that lives in a nest of twigs and stones above the ground in the winter and spring. In the summer and autumn the ants build a nest below the ground level. A scientist investigating this nesting behaviour hypothesized that temperature is the controlling factor.

Design an experiment to investigate this hypothesis.

OR

(b) Charles Darwin (1809-1882) suggested that organisms present on the earth have arisen by a process of slow and gradual change over many generations through a process called natural selection. This is called the Theory of Evolution. Evidence supporting Darwin's theory has been so substantial that few biologists doubt its validity.

Explain why biologists support this Theory. In your answer discuss the evidence from each of the following areas of biology: classification, comparisons of the structures of different organisms, fossils, and embryological development.

OR

(c) A mouse homozygous for black coat (B) and long ears (L) is crossed with a mouse homozygous for white coat and short ears, black coat and long ears being dominant characters.

Explain, using words and symbols, the ratios of offspring you would expect in the F_2 generation, if coat colour and ear size are controlled by genes carried on the same chromosome.

END OF PAPER