

TERTIARY ENTRANCE EXAMINATION, 1989  
QUESTION/ANSWER BOOKLET

**BIOLOGY**

Please place one of your student  
identification labels in this box

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STUDENT SEA NUMBER—In figures

In words

TIME ALLOWED FOR THIS PAPER

Reading time before commencing: Ten minutes  
Working time for paper: Three hours

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

TO BE PROVIDED BY THE SUPERVISOR

This Question/Answer Booklet comprising 31 pages and 37 questions  
Separate Multiple Choice Answer Sheet  
Standard Answer Book  
Paper binder

TO BE PROVIDED BY THE CANDIDATE

Standard Items  
Pens, pencils, eraser or correction fluid, ruler  
Special Items  
A '2B' pencil for the Separate Multiple Choice Answer Sheet

IMPORTANT NOTE TO CANDIDATES

No other items may be taken into the examination room.

It is your responsibility to ensure that you do not have any unauthorised notes or other items of a non-personal nature in the examination room. Please check carefully, and if you have any unauthorised material with you, hand it to the supervisor BEFORE reading any further.

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## SECTION A

Suggested time: 40 minutes (30 marks)

Record each answer for questions 1-30 by marking your choice of alternatives on the separate Multiple Choice Answer Sheet using a '2B' pencil.

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

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

1. Evolution, the idea that all living things have arisen from a common ancestor, may be considered a/an \_\_\_\_\_

(a) natural law.  
(b) hypothesis.  
(c) theory.  
(d) educated guess.

2. Which of the following is the most likely characteristic for a marine iguana, living on the shores of the Galapagos Islands and feeding on algae encrusting the rocks?

(a) A kidney that excretes copious quantities of dilute urine.  
(b) A naked, moist skin.  
(c) Glands on the snout that excrete water with a salt concentration greater than seawater.  
(d) A pointed snout.

3. In an experiment to investigate the movement of liquid in trees, a very small heating element was inserted into the xylem to heat the contents for a few seconds. Two thermocouples were placed at equal distance above and below the heating element to record changes in the temperature of the liquid.

It is expected that a change in temperature would be recorded by

(a) both thermocouples at the same time.  
(b) the top thermocouple before the bottom one.  
(c) the bottom thermocouple before the top one.  
(d) neither of the thermocouples.

4. If a piece of lower epidermal tissue is peeled off a leaf and floated on water, the stomata present will

(a) close because the guard cells become more turgid.  
(b) close because the guard cells become less turgid.  
(c) open because the guard cells become more turgid.  
(d) open because the guard cells become less turgid.

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5. Water loss from leaves can be prevented by smearing Vaseline over their surfaces. An investigation was carried out to compare the water loss from two groups of leaves collected from the same branch. The following results were obtained.

	Group 1 upper surface of leaves covered in Vaseline	Group 2 lower surface of leaves covered in Vaseline
Initial weight (g)	40	40
Weight after two days (g)	35	25

Assuming that both groups of leaves were exposed to the same conditions, it can be concluded from these results that

- (a) there are more stomata on the upper surface of the leaves than on the lower surface.  
(b) the rate of transpiration in Group 1 was greater than in Group 2.  
(c) the leaves of this plant naturally hang vertically.  
(d) the cuticle on the upper surface of the leaves is thicker than that on the lower surface.

6. A biologist conducted an experiment to determine the effects of ring-barking a single branch on a grape-vine with many branches. The process of ring-barking involved removing a complete ring of bark around the stem.

The following observations were made

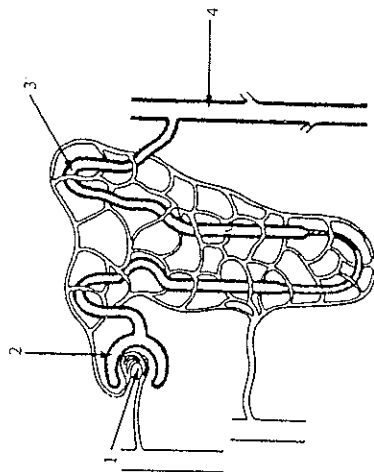
- the leaves on the ring-barked branch showed no difference from leaves on other branches.  
- the grapes on the ring-barked branch were identical in size and colour to the grapes on other branches.  
- the grapes on the ring-barked branch had a greater sugar content than the grapes on other branches.

These observations suggest that ring-barking causes damage to

- (a) the xylem tissue, which prevents substances from entering the ring-barked branch.  
(b) the xylem tissue, which prevents substances from leaving the ring-barked branch.  
(c) the phloem tissue, which prevents substances from entering the ring-barked branch.  
(d) the phloem tissue, which prevents substances from leaving the ring-barked branch.

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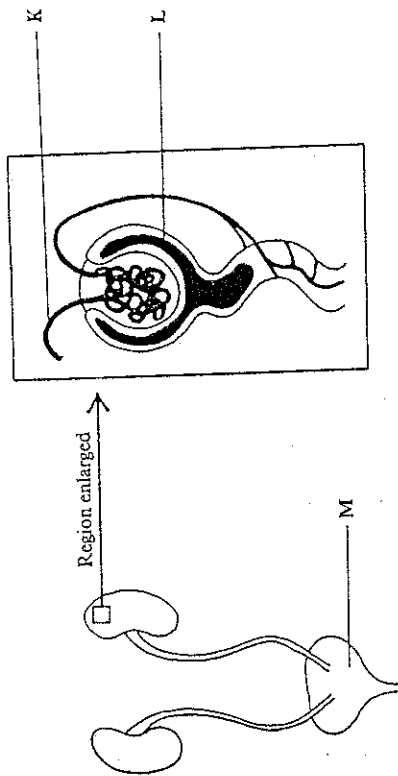
7. The diagram below represents a nephron in a human kidney:



Which one of the following combinations correctly identifies the labelled structures?

	1	2	3	4
(a)	Bowman's capsule	glomerulus	collecting duct	tubule
(b)	glomerulus	Bowman's capsule	collecting duct	tubule
(c)	glomerulus	Bowman's capsule	tubule	collecting duct
(d)	Bowman's capsule	glomerulus	tubule	collecting duct

8.



It is possible to study the way the kidney functions by measuring the volume of fluid that flows through different parts of the excretory system (see figure above), and by chemically analysing fluid drawn from each part. From your knowledge of the structure and function of the mammalian excretory system, you would expect

- Fluid in region L to contain blood cells, large blood proteins, glucose, salts, and nitrogenous wastes.
- Fluid in region K to contain glucose, salts, and nitrogenous wastes in higher concentrations than in L.
- Fluid in region M to contain higher concentrations of glucose, and higher concentrations of nitrogenous wastes than in L.
- Fluid to be reabsorbed between L and M.

9. One of the hormones that act on the kidney nephron is aldosterone, which is produced by the adrenal glands.

Aldosterone increases the absorption of sodium ions from the tubule and collecting duct, and increases the secretion of potassium ions into them.

Aldosterone production is controlled by a complex process involving sodium and potassium ion concentrations in the bloodstream.

In this example of homeostasis

- a decrease in sodium concentration in the blood would result in a decreased secretion of aldosterone.
- an increase in potassium ion concentration in the blood would result in an increased secretion of aldosterone.
- aldosterone production is regulated by positive feedback involving the concentration of sodium and potassium ions.
- an increase in aldosterone secretion would cause an increase in the amount of sodium ions in the urine.

10. After examining a group of vessels in the circulatory system of a mammal, a biologist wrote: "The vessels resemble veins in structure, but the walls are thinner. They also contain numerous valves. The smallest of these vessels are irregular in shape and end blindly in the tissues". The vessels that the biologist was describing were

- (a) lymph vessels.
- (b) capillaries.
- (c) arteries.
- (d) venules.

11. Insects have an open circulatory system in which blood is not confined to blood vessels but flows in spaces in the tissues so that each cell is bathed in blood. Active insects can survive with this type of system because they do not rely on blood to transport oxygen. On the basis of this information, which one of the following would you expect to be absent from the blood of insects?

- (a) Oxygen.
- (b) White blood cells.
- (c) Red blood cells.
- (d) Glucose.

12. An organism has been caught that attaches to the side of fish and sucks blood and body juices out of the fish for food. When dissected, what would you be most likely to find?

- (a) A very short, simple digestive tube.
- (b) A long digestive tube with many blind pouches.
- (c) No digestive tube.
- (d) A digestive tube like that of a pond snail.

13. Which of the following best applies to an endocrine gland?

- (a) Its products are secreted into a duct and carried in it to their target organ.
- (b) Its products are secreted directly into the blood stream.
- (c) Its products are secreted directly into the digestive system.
- (d) Its secretions nearly always have an almost instantaneous regulatory effect upon its target organ(s).

14. Co-ordination in animals is brought about by nerves and hormones, and

- (a) both work by chemicals being transported by the blood.
- (b) hormones act more quickly by reflex arcs.
- (c) the stimulus is controlled by nerves and the response by hormones.
- (d) both may interact to produce a response.

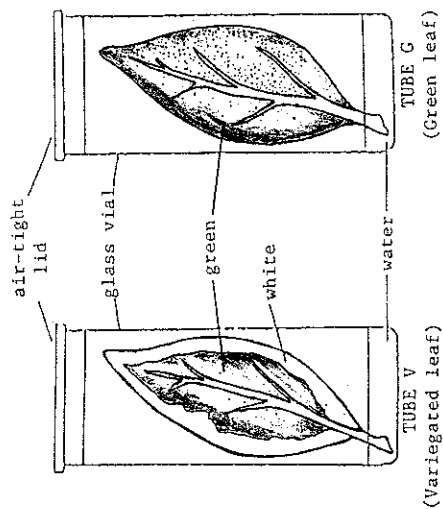
15. To proceed at a rate sufficient to maintain life, reactions in living cells require

- (a) an increase in substrate concentrations.
- (b) a rise in overall temperature.
- (c) appropriate enzymes.
- (d) glucose and oxygen.

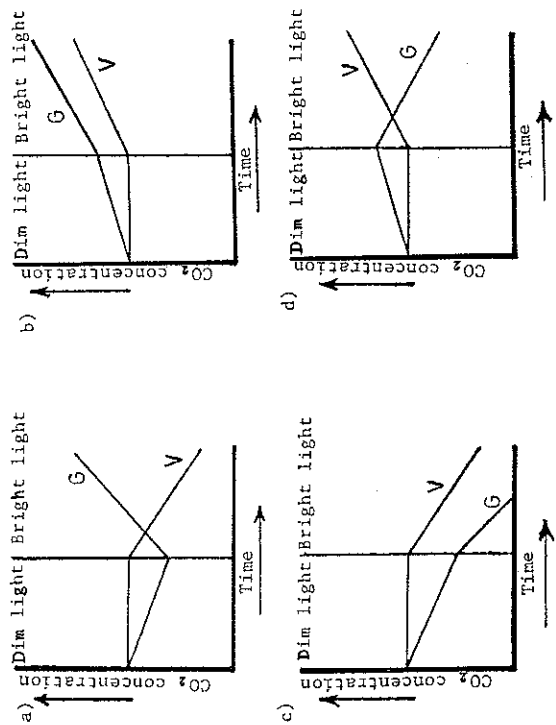
16. Which of the following pairs of organelles would be involved in the production or use of  $\text{CO}_2$  in a plant cell?

- (a) Mitochondria, golgi body.
- (b) Golgi body, lysozyme.
- (c) Golgi body, ribosome.
- (d) Mitochondria, chloroplast.

17. Two leaves are enclosed in tubes V and G as shown. Each leaf is of similar area, but the one in tube V is variegated and the one in tube G is green. When the variegated leaf is in dim light, the rate of respiration is equal to the rate of photosynthesis.

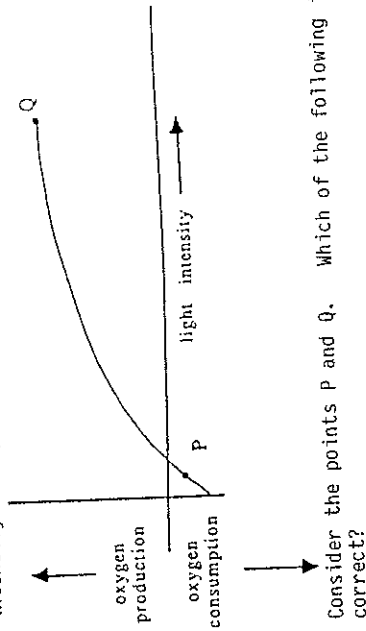


Which of the following graphs illustrates the change in carbon dioxide concentration for tubes V and G when the light is altered from dim to bright?



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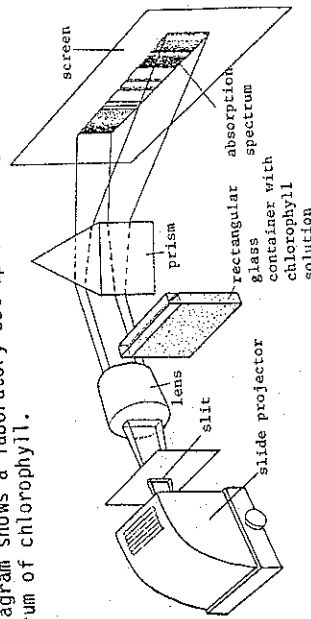
18. The relationship between oxygen production, oxygen consumption and light intensity in a plant is shown in the following diagram.



Consider the points P and Q. Which of the following is correct?

- At Q, the rate of respiration exceeds the rate of photosynthesis. At P, the rate of photosynthesis exceeds the rate of respiration.
- Both photosynthesis and respiration are occurring at P, photosynthesis alone is occurring at Q.
- Respiration alone is occurring at P, photosynthesis alone is occurring at Q.
- At P, the rate of respiration exceeds the rate of photosynthesis. At Q, the rate of photosynthesis exceeds the rate of respiration.

19. The diagram shows a laboratory set-up for studying the absorption spectrum of chlorophyll.



If the chlorophyll solution were placed between the light source and the prism, what changes would this make to the spectrum?

- The spectrum would have green blocked out since chlorophyll absorbs green light.
- The spectrum would have green since chlorophyll transmits green.
- It would be impossible to tell without knowing the absorption spectra of chlorophyll.
- Red and violet would be the only colours on the spectrum.

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20. Twins which developed from a single fertilized egg were found to differ in their scores in an intelligence test by about 9 points. This was probably due to

(a) their parents differing in their intelligence.  
 (b) one twin always being superior in intelligence to the other.  
 (c) different genetic material in either twin.  
 (d) environmental factors during growth.

21. In which of the following organism(s) would offspring show the greatest genetic variation compared with the adult organism?

(a) A budding *Hydra*.  
 (b) An inbred population of laboratory mice.  
 (c) Grey kangaroos in south-west Australia.  
 (d) A self-pollinated plant.

22. In order to label chromosomes radioactively, it is sufficient to grow cells in a nutrient solution containing a radioactive nucleotide. A cell "labelled" in this way was allowed to divide once in the absence of the radioactive nucleotide.

The greatest amounts of radioactivity would be detected in

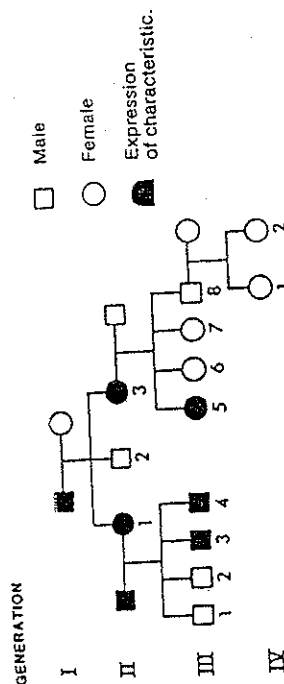
(a) the nucleus of both daughter cells.  
 (b) the nucleus of only one daughter cell.  
 (c) the nucleus and cytoplasm of both daughter cells.  
 (d) the nucleus and cytoplasm of only one daughter cell.

23. In grasshoppers, the sex-determining mechanism is XX (female) and XO (male).

The females have two X chromosomes plus nine pairs of autosomes, and males have a single X chromosome plus nine pairs of autosomes. If eye-colour is determined by one of three alleles at a single locus (i.e. position) on the X chromosome of this grasshopper, then

(a) all gametes produced by females will have ten chromosomes and one of six possible genotypes for eye-colour.  
 (b) all gametes produced by females will have ten chromosomes and one of three possible genotypes for eye-colour.  
 (c) all gametes produced by males will have ten chromosomes and one of six possible genotypes for eye-colour.  
 (d) all gametes produced by males will have nine chromosomes and one of three possible genotypes for eye-colour.

24. The family pedigree below shows the inheritance of a particular trait or characteristic in a family.



From the diagram we can be certain that a gene for this characteristic is present in each of

- (a) the four parents in generation II.  
 (b) both parents from generation I.  
 (c) neither parent in generation III.  
 (d) child 2 from generation II.

25. In sweet peas, tallness (T) is dominant to dwarfness (t). Which one of the following crosses would result in half of the offspring being tall?

(a) TT x tt  
 (b) Tt x tt  
 (c) Tt x Tt  
 (d) Tt x Tt

26. According to fossil evidence, crocodiles have changed very little since the end of the Triassic Period (195 million years ago).

The most likely reason why crocodiles have survived unchanged is that they

(a) live in environments similar to those where they first evolved.  
 (b) are too fierce to be attacked by other animals.  
 (c) are able to adapt to changes in the environment.  
 (d) withstand evolutionary change better than warm-blooded animals.

27. Many difficulties are found in making interpretations from the fossil record. Which of the following is such a difficulty?

(a) The record for many lineages is incomplete.  
 (b) Forms exist which are transitional between fossil groups.  
 (c) Nearly all fossils are formed from marine organisms.  
 (d) Fossilization usually involves the hard parts of the organism.

28. Many insects on isolated oceanic islands are flightless, even though their close relatives some distance away on the mainland retain their wings.

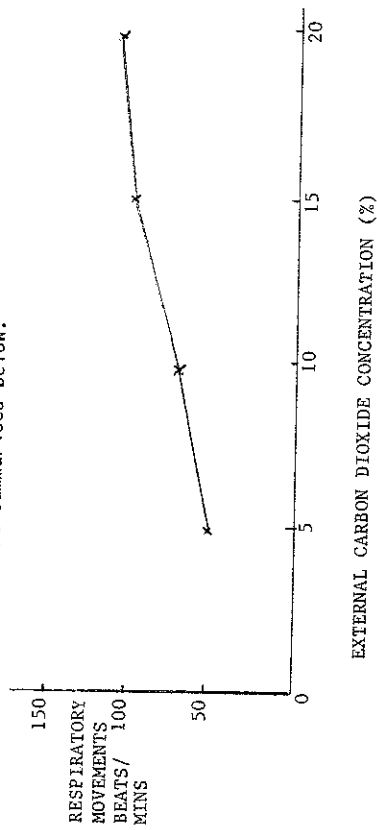
The most likely explanation for the above is that

- (a) because there is nowhere to fly to, the wings were lost.
- (b) insects with wings are more likely to be blown out to sea and die.
- (c) the ancestral insects that reached the islands from the mainland were mutants with no wings.
- (d) many families of insects do not have wings, e.g. ants in the order Hymenoptera.

29. Human populations are beginning to lose their distinctiveness primarily as a direct result of today's

- (a) increased migration between countries.
- (b) decreasing mutation rate in human beings.
- (c) population explosion and wars.
- (d) increase in inter-racial matings.

30. The results of an experiment studying the influence of external  $\text{CO}_2$  concentration on the frequency of respiratory movements in a fresh-water crustacean are summarised below.



Which of the following statements best describes the results?

- (a) Increases in external  $\text{CO}_2$  concentration cause increases in the frequency of respiratory movements.
- (b) An increase in external  $\text{CO}_2$  concentration aids gas exchange across the respiratory surfaces.
- (c) The frequency of respiratory movements is related to the external concentration of  $\text{CO}_2$ .
- (d) Respiration rate in crustaceans is controlled by external  $\text{CO}_2$  concentration.

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NOTE: SECTION B COMMENCES ON P.16

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## SECTION B

Suggested time: 90 minutes (46 marks)

Attempt all questions in the section.

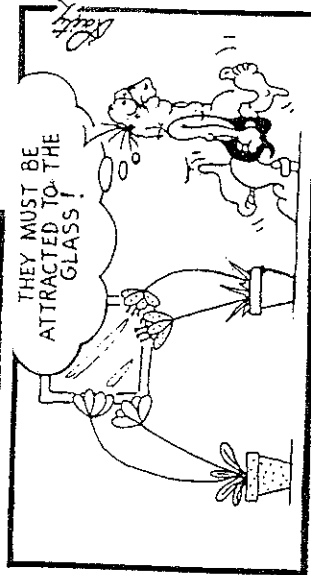
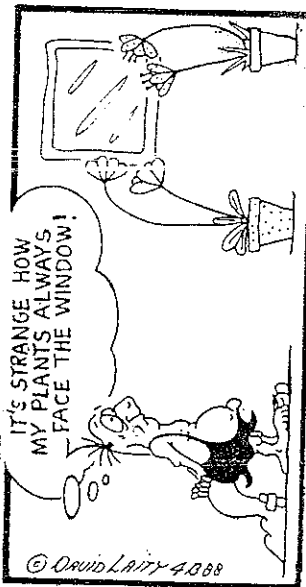
Write your answers in the space provided.

Candidates **MUST** use a black or blue pen or biro when answering Sections 8 and C.

31. (13 marks)

The cartoon below, featuring Ro Dent appeared in the West Australian this year.

## RAT RACE



(reproduced by kind permission of David Laity)

- (a) From your knowledge of Biology and your observations of the cartoon, construct one hypothesis which will account for the behaviour of the plants in the cartoon. (2 marks)

- (b) What sort of statement has Ro Dent made? ( $\frac{1}{2}$  mark)

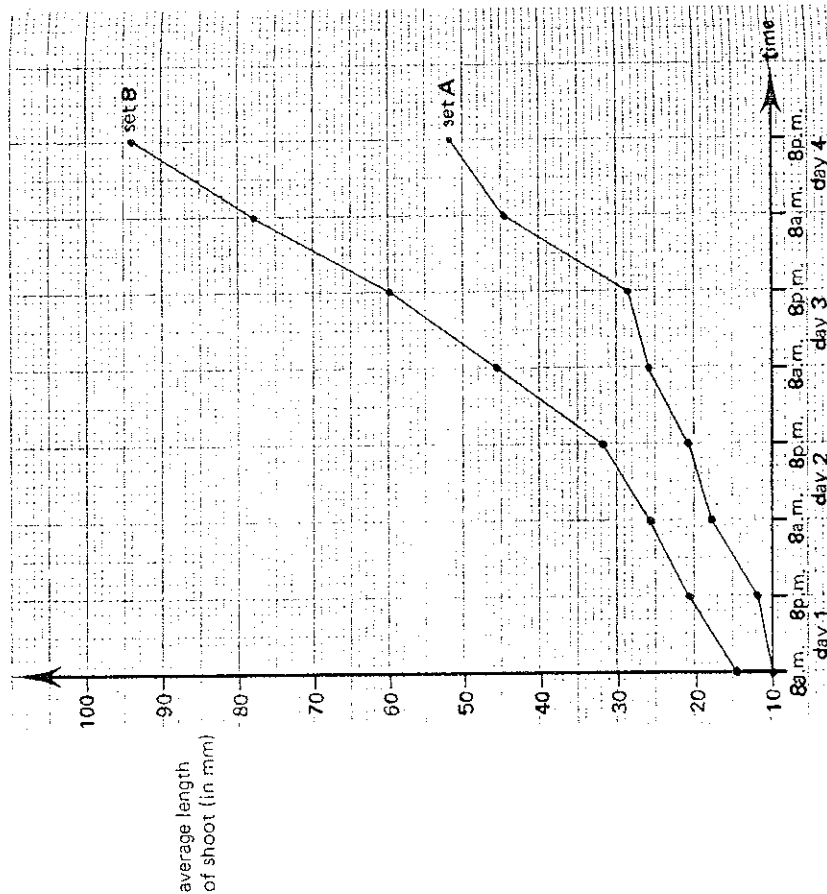
- (c) Design an experiment to test your hypothesis. In your design, identify the controlled, experimental and responding (dependent) variables. (4½ marks)



31. (continued)

A scientist investigating the growth of broad beans obtained the following results. Set A was placed on a bench in the laboratory, whereas Set B was placed in a dark cupboard.

The shoot (plumule) lengths were measured twice daily, and the average results are shown on the following graph.



(d) From the graph record the average shoot lengths of the two sets of beans at 2 a.m. on day four. (1 mark)

Set A

Set B

31. (continued)

(e) Compare the two curves and explain the differences. (2 marks)

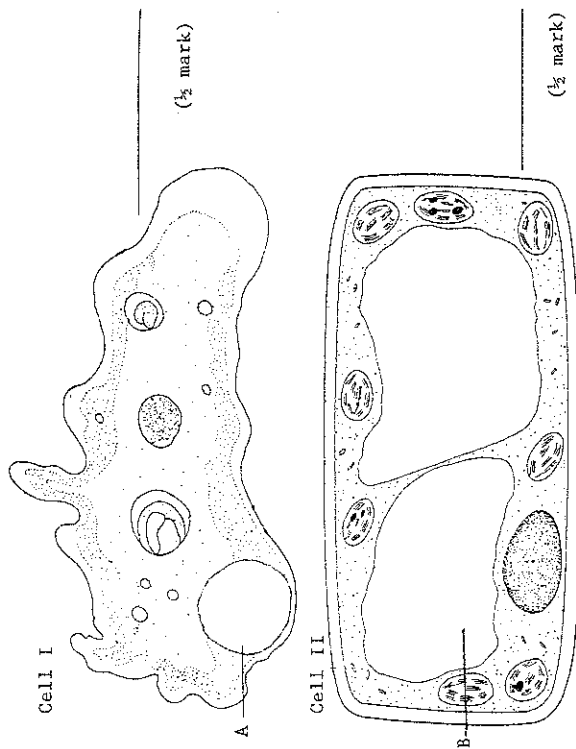
(f) Suggest what the plants in Set B would look like after four days in the dark. (1 mark)

(g) Describe, with reasons, the future growth and development of the seedlings in Set B. (2 marks)

32. (10 marks)

Cells of plants and animals from a freshwater pond have certain structures in common and other features which are specific to each.

(a) Examine the cells diagrammed below and write next to each whether it was an animal or a plant cell.



(b) List four reasons for your choice in (a) (2 marks)

(c) Identify the structure marked A: \_\_\_\_\_ and state its function: \_\_\_\_\_ (1 mark)

(d) State TWO differences between the contents of Structure A and Structure B. (1 mark)

32. (continued)

(e) Describe any changes you would expect to observe if an iodine solution was added to cell II. (1 mark)

(f) Would you expect all the proteins in both cells to be the same? Explain. (1 mark)

(g) Supposing that the cells were placed in sea water. What effects would you expect to observe? Why? (i) on Cell I? (1 mark)

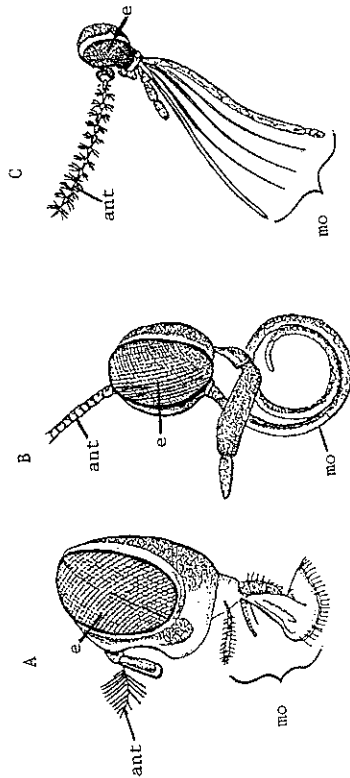
(ii) on Cell II? (1 mark)

(h) If the cells were then transferred to distilled water, what effects would you expect to observe (i) on Cell I? (½ mark)

(ii) on Cell II? (½ mark)

33. (6 marks)

The diagram below illustrates the head and mouth parts of three different insects. One is a nectar feeder, one feeds on blood and the other feeds on soluble solids.



Structures labelled are: ant - antenna; e - eye; mo - mouth parts.

(a) Identify which one feeds on nectar, and explain your choice. (1½ marks)

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(b) Which of the diagrams shows the mouth parts of a mosquito? Describe the evidence which you used to identify the mosquito. (1½ marks)

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(c) All the insects spend a lot of time flying, an activity for which sight is important but touch is not. Give two possible functions of the antennae. (1 mark)

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33. (continued)

(d) Adult bees feed on nectar obtained from flowers. Write down the changes that must happen to the protein in nectar before the bee can make use of it. (2 marks)

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34. (6 marks)

Catechol is a substance found in many plants. When exposed to the enzyme tyrosinase, it changes from colourless to dark brown. The table below shows the time taken for the colour change when catechol of different concentrations was used.

Catechol concentration (g/L)	Time to convert to dark brown colour (secs)
0.5	25
1.0	47
2.0	92
3.0	134
4.0	187

(a) If you were to plot these data on a graph, what shape of curve would you expect to draw? (1 mark)

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(b) What do these data indicate about the rate of enzyme activity? (1 mark)

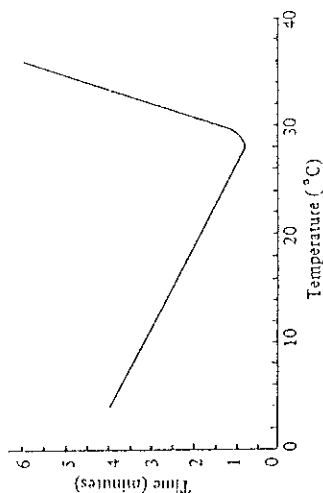
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34. (continued)

The graph below shows the result of experiments in which samples of 4g/L catechol and 5 drops of tyrosinase were subjected to different temperatures and the time for the brown colour to appear was measured.



(c) State the temperature at which the reaction was proceeding fastest. (1 mark)

(d) Explain why the slopes of the curve above and below this temperature are different. (2 marks)

A second experiment investigated the action of tyrosinase on catechol and two related compounds, resorcinol and hydroquinone. The following table shows the rate of action of tyrosinase on the three substances.

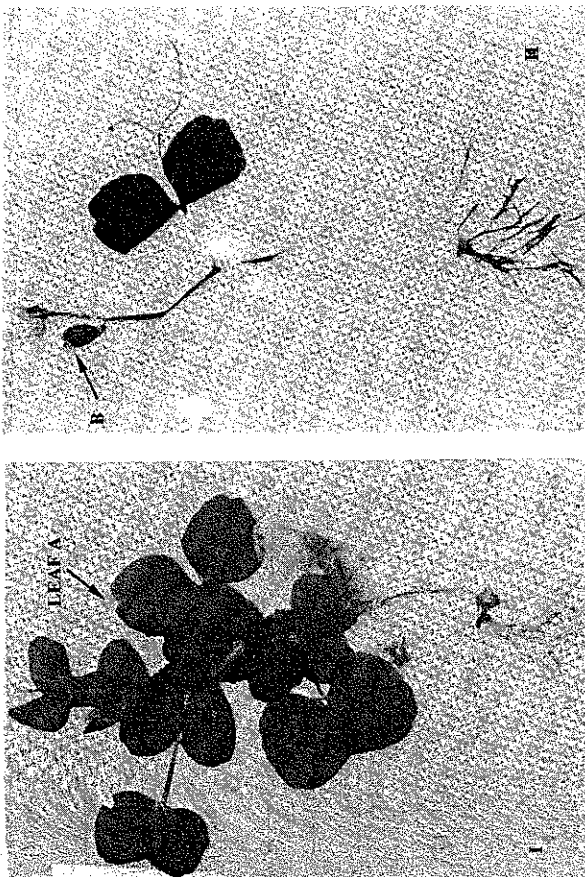
	Catechol	Resorcinol	Hydroquinone
Amount of product after 5 mins (arbitrary units)	40	10	0

(e) Is resorcinol or hydroquinone more structurally similar to catechol? Explain your answer. (1 mark)

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35. (11 marks)

The photographs below illustrate the same pea plant. Photograph I shows the plant in normal light. Photograph II is an autoradiograph of the plant. An autoradiograph is produced when an object containing radioactive atoms, e.g. Carbon-14 is pressed against a piece of photographic film for a period of time. In this case, leaf (A) of the pea plant was exposed in a bright light to carbon dioxide gas containing Carbon-14 for half an hour.



(a) In what form would the radioactive carbon be found in the plant? (1 mark)

(b) Explain why the autoradiograph shows darkening in the root region of the plant. (1 mark)

(c) Why would region (B) of the plant be well supplied with carbon compounds? (1 mark)

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35. (continued)

A purple-flowered pea plant was discovered among a strain of white-flowered plants which had been breeding true for many generations. When this purple-flowered plant was crossed with white-flowered plants, half the offspring had purple flowers and half had white flowers.

(d) If these purple-flowered offspring were crossed together, what proportions of white-flowered and purple-flowered plants would you expect in the next generation? (1 mark)

(e) Suppose that as a result of such a cross 796 purple-flowered plants and 405 white-flowered plants were produced. What can you say about the mode of inheritance of the purple-flowered gene? (1½ mark)

(f) Explain why the observed results are not quite the same as expected. (1 mark)

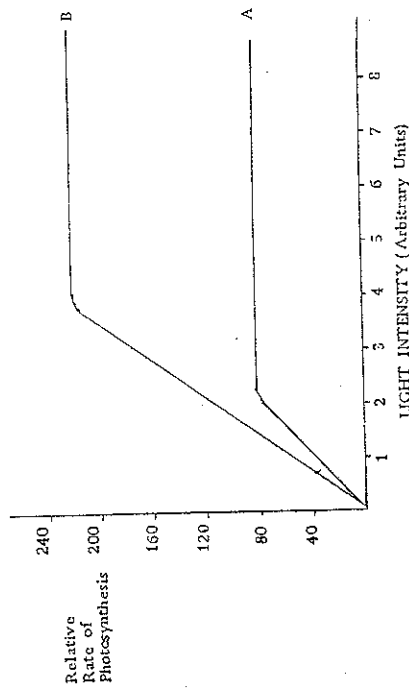
(g) How do you explain the occurrence of the purple flower allele in this population of peas? (½ mark)

The graph on the opposite page shows the result of an experiment investigating the effect of different light intensities on the rate of photosynthesis of pea plants.

(h) What factor is most likely to have produced the difference in results shown by line B compared with line A? (1 mark)

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35. (continued)



It is possible to measure the contribution to total photosynthesis of all photosynthetic organisms in a well defined community. This can be represented as  $T_p$ .

Similarly, it is possible to measure the contribution to total respiration of all organisms in the same well defined community. This can be represented as  $T_r$ .

(i) Is the same set of organisms used in calculating  $T_p$  as in calculating  $T_r$ ? Explain. (1 mark)

(j) In small headwater streams of a river system (such as take water from the forested areas of the Darling Scarp) it is always found that  $T_p$  is less than  $T_r$ . What can you conclude from this result? (1 mark)

(k) What must be occurring if this community is continuing to exist for a long period of time? (1 mark)

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## SECTION C

Suggested time: 50 minutes (24 marks)

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

USE THE SEPARATE ANSWER BOOK FOR SECTION C ANSWERS

Each question is worth 12 marks. Answer both questions in **essay** form. Where possible, support your answers with labelled diagrams. TWO marks may be deducted from each answer which is poorly presented, set out in point form or written with other than a blue or black pen or biro.

36. EITHER

- (a) The digestive system of a vertebrate animal is composed of many parts, each with a particular structure and function. List the major parts and relate the structure of each to the function it performs. If enzymes are active in any part, make sure you describe their source, substrates and products, and any special conditions necessary for their action.

OR

- (b) In order for them to survive, plants and animals need to transport both water and nutrients around their bodies. However, different systems and processes are used by each. Compare and contrast the systems and processes by which substances are transported within a tree such as a Eucalypt with those of an animal such as a Kangaroo.

OR

- (c) Green plants require matter and energy in order to survive. These enter the body of the plant in different forms.
- (i) Discuss the sources of these requirements and the evidence which is available to show that these substances are either used or produced by a plant during the day.
- (ii) Also carefully explain how a leaf could regulate its water content throughout a summer day.

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37. EITHER

- (a) During a 24-hour period in Antarctica, a husky dog would spend time sleeping in the snow and some time working at pulling a sled across the ice. However, its core body temperature would remain relatively constant at  $38^{\circ}\text{C}$  throughout the 24 hours.



Describe the structures and processes of the dog's body which maintain this constant body temperature.

OR

- (b) Cells in a flowering plant may undergo one of two cell division processes depending upon where they are located. Describe these two processes, making sure to include in your discussion where the processes occur, what is the purpose of each, and any differences between the two. Clearly labelled diagrams **MUST** be included in your answer.

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37. (continued)

OR

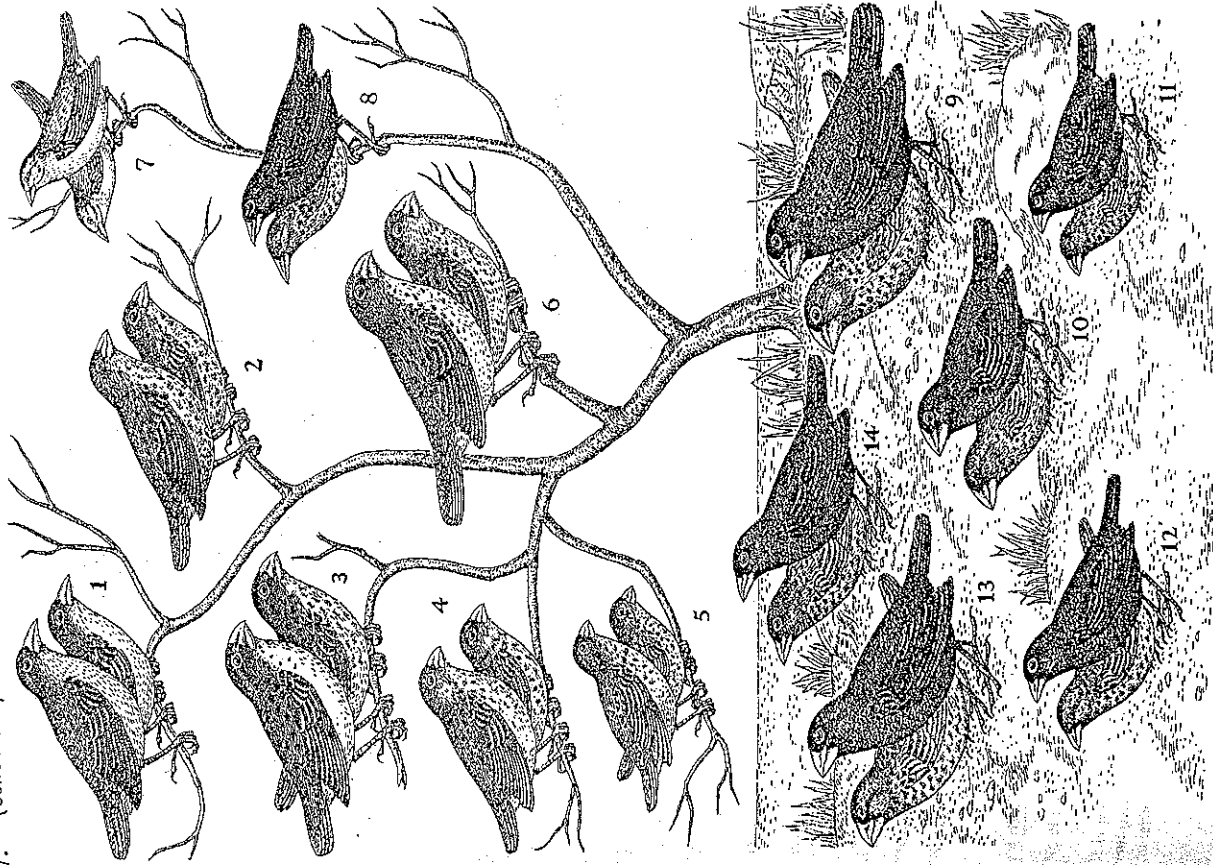
(c) When Charles Darwin visited the Galapagos Islands in 1835 he observed a group of finch-like birds on many of the islands. Study showed that there were fourteen related species living on this group of isolated islands. While obviously similar in basic form, significant differences among the species can be seen. The figure opposite shows these species, and the table below gives their names and food preference.

(i) Select four structural differences between the birds and explain the reasons for these differences.

(ii) Explain the process by which these differences would have arisen.

Number	Common Name	Food
1	Woodpecker finch	insects
2	Mangrove finch	insects
3	Large tree finch	insects
4	Medium tree finch	insects
5	Small tree finch	insects
6	Vegetarian tree finch	buds and fruit
7	Warbler finch	insects
8	Cocos Island finch	insects
9	Large ground finch	seeds
10	Medium ground finch	seeds
11	Small ground finch	seeds
12	Sharp beaked ground finch	cactus
13	Large cactus finch	seeds and cactus
14	Small cactus finch	seeds and cactus

37. (continued)



END OF PAPER

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