

**TERTIARY ENTRANCE EXAMINATION, 1994**  
**QUESTION/ANSWER BOOKLET**

**BIOLOGY**

Please place your student identification label in this box

SEA STUDENT NUMBER -- In figures

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In words

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**TIME ALLOWED FOR THIS PAPER**

Reading time before commencing work: 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 33 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 and calculators satisfying the conditions set by the Secondary Education Authority.

**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. If you have any unauthorised material with you hand it to the supervisor **BEFORE** reading any further.

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## INSTRUCTIONS TO CANDIDATES

This paper comprises three sections – A, B and C.

Marks will be allocated as follows:

SECTION A – 60 marks

SECTION B – 100 marks

SECTION C – 40 marks

In **SECTION A**, attempt all questions in this section, using the Separate Multiple Choice Answer Sheet. Use a 2B PENCIL. DO NOT use a ball point or ink pen. Marks are not deducted for wrong answers.

In **SECTION B**, attempt all questions in this section and write your answers in the places provided in this Question/Answer Booklet. Use a blue or black PEN (not pencil) for this section.

In **SECTION C**, attempt one alternative from each of the questions and write your answers in the Standard Answer Book. Use a blue or black PEN (not pencil) for this section. Do NOT copy the questions when writing your answers. Merely write the number of the question in the margin.

## MOST IMPORTANT

At the end of the examination make sure that your SEA Student Number is on your Question/Answer Booklet and Standard Answer Book(s).

At the end of the examination the Question/Answer Booklet must be attached to the FRONT of the Standard Answer Book(s) with the paper binder provided.

The Separate Multiple Choice Answer Sheet will be collected separately by the Supervisor.

SEE PAGE 3

## SECTION A

Suggested time: 40 minutes (60 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 a new one.

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

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1. After treatment with Aceto-orcein, a stain which is taken up by chromatin, some cells from a garden pea plant (*Pisum* sp.) were examined at high magnification with a microscope. Some of the structures in a cell which were in focus appeared as shown in DIAGRAM 1.

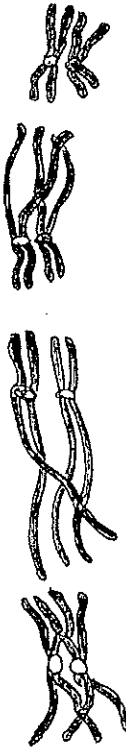


DIAGRAM 1

Which of the following statements best describes a process that is occurring in the cell?

- (a) The cell is from a tissue which is growing and cell division is increasing the number of cells.
- (b) The cell is undergoing mitosis, where homologous chromosomes are pairing.
- (c) Sections of chromatids from different parental chromosomes are being exchanged.
- (d) Duplication of chromosomes is producing diploid cells which will become gametes.

SEE PAGE 4

Questions 2 to 4 inclusive are based on the following information and the experimental set-up illustrated in DIAGRAM 2.

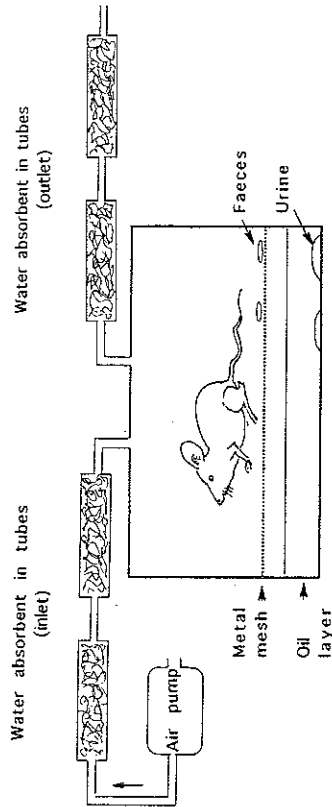


DIAGRAM 2

The equipment was arranged in a laboratory as shown in DIAGRAM 2. The mass of the outlet tubes was recorded using the balance and then a small mammal of known body mass was placed in the chamber for two hours. After two hours the mass of the outlet tubes was again recorded. Records were kept as follows:-

DATE: 14 Sept. '94		TEMPERATURE IN CHAMBER 22°C			DURATION (hours)
TYPE OF ANIMAL	ANIMAL MASS (g)	INITIAL MASS OF OUTLET TUBES (g)	FINAL MASS OF OUTLET TUBES (g)	INCREASE IN MASS OF OUTLET TUBES (g)	
mouse	4	29.82	30.02	0.2	2
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—

2. Which of the following aspects of the physiology of a mouse could **not** be measured with the equipment shown in DIAGRAM 2?

- The metabolic rate of a mouse.
- The rate of total water loss from a mouse.
- The rate of urine production by a mouse.
- The rate of water loss from the lungs and skin of a mouse.

SEE PAGE 5

3. Which of the following is a **good** reason for having a layer of oil beneath the animal in the chamber?

- Urine will sink beneath the oil and will not evaporate.
- Faeces will float on the oil and will be easy to collect.
- Oil will prevent the animal from interfering with its wastes.
- Urine will float on the oil and will evaporate quickly.

4. Data recorded on the data sheet can be summarised by calculating a single number. Which of the following is a correct summary of the data?

- Evaporative water loss was 0.1 g/hour.
- Evaporative water loss was 0.2 g/g of animal/hour.
- Evaporative water loss was 0.025 g/animal/hour.
- Evaporative water loss was 0.025 g/g of animal/hour.

5. Insect development is regulated by hormones produced by regions of the brain, as indicated in DIAGRAM 5.

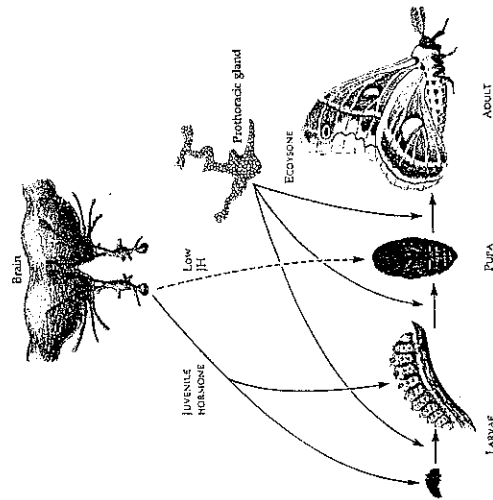


DIAGRAM 5

From information given in DIAGRAM 5, which of the following is **most** likely?

- Juvenile hormone causes the insects to moult.
- Ecdysone, by itself, causes the changes in structures at each moulting stage.
- Ecdysone has a feed-back effect on the amount of juvenile hormone produced.
- Juvenile hormone and ecdysone together stimulate development of the adult.

SEE PAGE 6

Information relevant to Questions 8 and 9.  
In many vertebrate animals the total amount of light which falls on the light sensitive retina of the eye can be controlled. For example, DIAGRAMS 8.1 & 8.2 show the pupil of a cat in conditions of very bright daylight and dim light:-

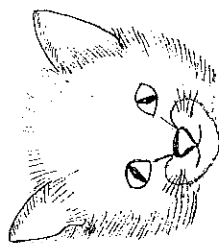


DIAGRAM 8.1: very bright daylight.

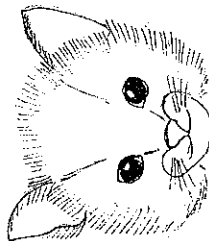


DIAGRAM 8.2: dim light.

This change in the pupil of the eye is an example of a stimulus - response - feedback pathway.

8. Which of the following is the stimulus?

- (a) The iris of the eye, which can open or close.
- (b) The size of the pupil in light of different intensities.
- (c) Light falling on the sensitive retina.
- (d) The nerve impulse from the retina to the iris.

9. Which of the following true statements describes a 'feedback' which can occur as the eye of the cat adjusts the size of the iris?

- (a) The iris of the eye opens and closes under the action of different sets of muscles.
- (b) Opening of the iris occurs in conditions of dim light, allowing more light to reach the retina.
- (c) Nerves from the retina connect to a part of the brain where impulses are interpreted as vision.
- (d) Nerve impulses from the retina cause muscles to close the iris after part of the retina is stimulated by bright light.

SEE PAGE 8

Countries cited in Questions 6 and 7 are indicated in DIAGRAM 6.

6. The Family Macropodidae includes many genera and species of kangaroos and wallabies, all of which occur naturally only on the 'Australia' side of the dashed (---) line which is shown on the map below. A great variety of placental mammals occur on the 'Asia' side of the dotted (.....) line.

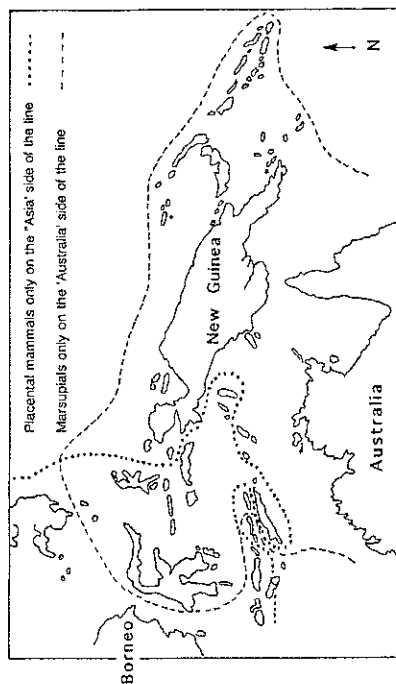


DIAGRAM 6

Which of the following is part of a satisfactory explanation for the distribution patterns?

- (a) Climatic conditions favour placental mammals west of the dotted line. To the south of the dotted line, climate favours the Macropodidae.
- (b) The Macropodidae have been competitively successful and have excluded placental mammals from the area on the 'Australia' side of the dotted line.
- (c) Macropodidae evolved on the continent of Australia. The dashed line is the limit of successful migration northward.
- (d) Placental mammals are successful in the region west of the dotted line and have had no need to extend their range further south.

7. Apes and monkeys (primates) occur in forest and woodland areas of Borneo but do not occur in New Guinea. In the forests of New Guinea and in parts of tropical Australia there are species of tree kangaroos and tree living wallabies.

Which of the following is most likely to be true?

- (a) In the absence of primates, some macropod marsupials have evolved to occupy a niche similar to that of tree living primates.
- (b) Tree living macropod marsupials have excluded primates from New Guinea by being more successful in competition for the same niche.
- (c) The evolution of tree living macropod marsupials occurred through the development of acquired characteristics because their ancestors were not tree dwellers.
- (d) Primates and macropods have become distinct species after becoming separated as independently evolving gene pools.

SEE PAGE 7

10. Carbon dioxide, methane and water vapour are all gases which occur in the atmosphere and bring about a 'greenhouse effect', reducing the loss of heat energy from Earth to space. Which of the following statements is true?

- (a) Large industrial areas which release a lot of carbon dioxide to the atmosphere are likely to experience local climate changes because of these emissions.
- (b) Local climate warming could occur in areas close to intensive cattle production because cattle release methane gas.
- (c) Uncontrolled increase in the emission of carbon dioxide and methane could increase the greenhouse effect of the atmosphere.
- (d) Human activities are unlikely to influence the atmosphere on a sufficient scale to affect the ecosystems of the world.

11. In domestic fowls an allele can occur which affects leg growth of heterozygous bearers. These heterozygotes have short legs and are called 'creepers'. The 'creeper' allele is lethal for fowls which are homozygous; they do not survive in the egg.

Two 'creeper' fowls were mated and, over a period of time, produced 48 chicks which hatched successfully. Of the 48 chicks, how many would you expect to have the normal phenotype?

- (a) 16.
- (b) None.
- (c) 32.
- (d) 12.

12. Early in 1994, researchers reported finding traces of the synthetic pesticide DDT in the soil of an undisturbed highland forest in a remote part of the USA. DDT is a chemical with a long 'half life': it does not break down quickly but persists for a long time in the environment. Which of the following is the most likely explanation of the occurrence of DDT in this forest?

- (a) DDT is a naturally occurring compound which can be found in most places in minute quantities.
- (b) Widespread spraying of crops with DDT caused some of it to be carried in the wind to the remote area.
- (c) DDT accumulated in the groundwater in areas where it was applied and gradually filtered through to the forest.
- (d) DDT accumulated in the tissues of non-migratory birds which inhabit the highland forest.

SEE PAGE 9

13. DIAGRAM 13 represents part of the development of a multi-celled animal.

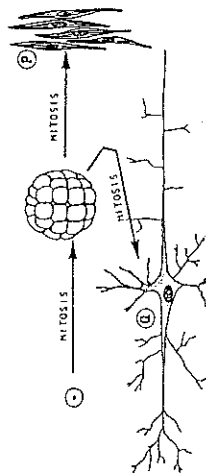
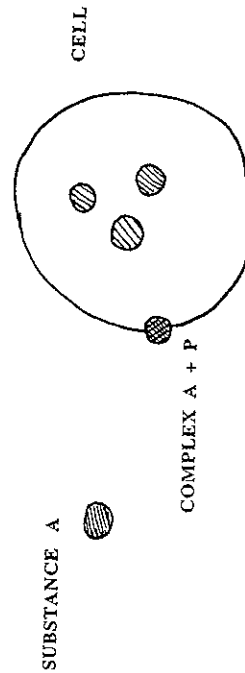


DIAGRAM 13

Cells P and Q, which form as the animal develops, have quite different sizes and shapes, and perform quite different functions in the multi-cellular body, because they

- (a) contain different chromosomes.
- (b) contain similar chromosomes with slightly different genes.
- (c) use different parts of their total genetic information.
- (d) contain different numbers of the same types of chromosomes.

14. Substance A, a large molecule, is present in low concentration in the environment of a cell. It is required inside the cell in high concentration. Substance A, in moving from the environment into the cell, binds with another large molecule P which is embedded in the cell membrane.



The movement of substance A, as described above, is an example of

- (a) diffusion.
- (b) osmosis.
- (c) pinocytosis.
- (d) active transport.

SEE PAGE 10

15. The Table below lists the thermal death points of a variety of fish.

FISH	ACCLIMATISATION TEMPERATURE (°C)	THERMAL DEATH POINT (°C)
CARP	20	31 - 34
GOLDFISH	10	30.8
GOLDFISH	20	34.8
GOLDFISH	30	38.6
RAINBOW TROUT	11	24
SPECKLED TROUT	15	25
YELLOW PERCH	15	27.7

Which of the following is the best explanation for the death of the fish at these temperatures?

- The thermal death point is not affected by the acclimatisation temperature.
- The enzyme systems of the fish cannot function at these temperatures.
- The increase in temperature affects the cell membranes causing disruption to cellular functioning.
- Changing the temperature reduces the ability of the fish to deal with pollution, resulting in death of the fish.

16. On a recent excursion to a freshwater pond near their school, biology students found several different aquatic organisms. Using references, the most common organisms were identified as water fleas which belong to the Sub-order Cladocera. Students were asked to draw all the animals they found (see DIAGRAM 16). The actual length of the body of the water flea was 4.5 mm. What is the magnification of the student's drawing?

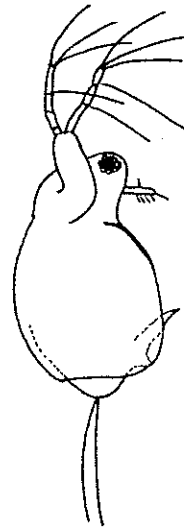


DIAGRAM 16

- 4x.
- 100x.
- 40x.
- 10x.

SEE PAGE 11

17. A potometer, a simple instrument used to measure transpiration rate in plants, is illustrated in DIAGRAM 17.

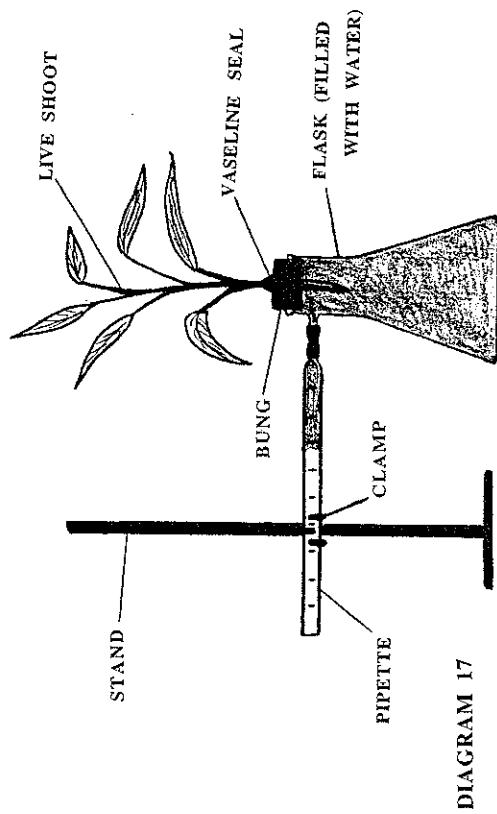


DIAGRAM 17

When setting up the equipment, care has to be taken to keep a continuous (unbroken) water column from the plant to the glassware. This is

- so that no bubbles will form in the xylem vessels to block the flow of water to the leaves.
- to make sure that the plant has a continuous supply of nutrients, therefore will not die during the experiment.
- to allow the water in the plant to drain into the flask, causing the measuring bubble in the pipette to move to the left.
- to show that the volume of water removed from the flask will remain constant, therefore measurements are easily read from the bubble in the pipette.

18. Populations of many species of amphibia, including frogs, are declining: the phenomenon is worldwide, and is causing concern to scientists studying amphibians and reptiles.

Scientists from Oregon State University in the USA have hypothesized that the phenomenon is caused by increasing levels of UV radiation, particularly of UV B, hindering the ability of the amphibians to reproduce.

If the hypothesis is correct, the phenomenon is a consequence of

- the greenhouse effect.
- thinning of the ozone layer.
- water pollution.
- eutrophication of water bodies.

SEE PAGE 12

19. The Table below lists mercury concentrations in some aquatic animals from Australia.

ANIMAL	AREA	MERCURY CONCENTRATION (ppm)
Whiting and bream	Botany Bay	Up to 8
Oysters	Botany Bay	Up to 2.8
Carfish, crabs and others	Brisbane and Pine Rivers and Moreton Bay	Up to 0.0125
Flathead and other fish	Off Altona, Melbourne	Up to 0.06
Jewfish, flounder and leatherjacket	Quibray Bay, N.S.W.	Up to 0.05
Oysters and mussels	Quibray Bay, N.S.W.	Up to 0.1
24 mixed species of fish	Botany Bay	Average 0.2
One specimen of tailor	Off La Perouse, N.S.W.	1.11
Flathead and trevally	Cook's R., N.S.W.	0.68 - 0.96
Oysters	Georges R., Port Stevens, Manning R., Hawkesbury R., Wallis Lake	Up to 0.017
School sharks longer than 71 cm	Vic., S.A. Coastal areas	Up to 2.9 Average 0.9

Which of the following is probably a true statement about mercury poisoning in different localities?

- Botany Bay is the most polluted because organisms near the bottom of the food pyramid (oysters and mixed fish) have high levels of mercury.
- Quibray Bay is the most polluted because the organisms found there have a consistently low mercury concentration in their tissues.
- Victorian and South Australian coastal areas are the most polluted because the organisms at the top of the food pyramid (e.g. sharks) have a low average mercury concentration.
- Brisbane and Pine Rivers and Moreton Bay are the most polluted because the scavenger species contain very low concentrations of mercury.

20. Many populations of frogs have declined in areas of Western Australia long after fish, a species of *Gambusia*, were introduced. The fish have become very successful in the localities where frogs were previously successful.

Which is the **least** likely explanation for the decrease in frog abundance?

- Gambusia* fish reduce the numbers of insect larvae in water, resulting in fewer insects as food for frogs.
- Gambusia* fish are more successful than tadpoles in competition for food.
- Gambusia* fish attack and injure tadpoles, affecting their development.
- Gambusia* fish are more successful than frogs in direct competition for the same food resource.

SEE PAGE 13

21. DIAGRAM 21 shows a vertical cross-section through a leaf.

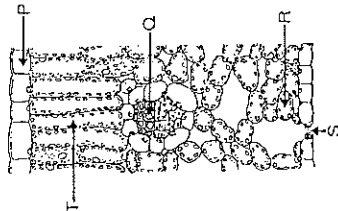


DIAGRAM 21

Photosynthesis takes place in the tissue labelled

- P, as this is where the sunlight is most direct and can be more readily absorbed.
- Q, as this is where the greatest number of chloroplasts are concentrated.
- R, using carbon dioxide which diffuses through S.
- T, using both carbon dioxide diffusing through Q and water vapour diffusing through S.

22. A Nobel prize was awarded to J. D. Watson and F. H. C. Crick for their work, published in 1953, describing the structure of the molecule known as DNA. It was possible to explain many biological phenomena using their structural model for DNA. Which of the following is a true statement about the phenomena that can be explained with the Watson-Crick model?

- Because each strand of DNA can have a unique sequence of bases, DNA can carry a genetic code.
- Because the overall shape of DNA is a double helix it is sufficiently complex to carry a genetic code.
- Because each of the four bases on one strand of DNA can only form bonds with the same base on the other strand, a sequential code can be copied.
- Because the sequence of bases differs on each strand of DNA, the molecule can carry coded information along each strand.

SEE PAGE 14

The following information is to be used when answering Questions 23 and 24.

23. DIAGRAM 23 shows a structure (X) which is typical of some animal cells; an organelle which appears to be very similar to the plasma membrane surrounding the cell. Which of the following labels applies to the structure X?

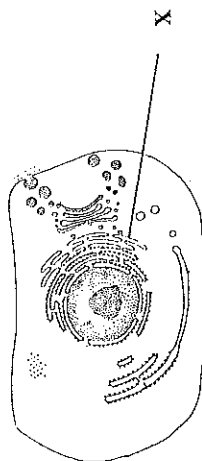


DIAGRAM 23

- (a) Vacuole membrane.
- (b) Cytoplasmic membrane.
- (c) Nuclear membrane.
- (d) Endoplasmic reticulum.

24. In some animal cells the structure marked X appears to be 'rough', with a regular arrangement of organelles called ribosomes attached closely to it. Which of the following best describes the role of these ribosomes in the functioning of the cells?

- (a) Ribosomes are the site of anaerobic respiration, where energy is released from
- (b) Ribosomes are involved in the assembly of protein molecules from amino
- (c) Ribosomes are organelles where digestive enzymes are packaged at high
- (d) Ribosomes are the sites of aerobic respiration in prokaryotes, enabling them to produce alcohol.

25. Prokaryote and eukaryote cells have significant structural differences. One important difference is seen in the presence or absence of cell organelles called mitochondria. Which of the following is true?

- (a) Mitochondria in eukaryotic cells enable aerobic respiration and metabolic breakdown of sugars to carbon dioxide and water to occur.
- (b) Mitochondria are the sites of aerobic respiration in prokaryotes, enabling them to produce alcohol.
- (c) In eukaryotic cells the anaerobic stage of respiration occurs in the mitochondria, allowing maximum production of ATP for each molecule of glucose.
- (d) All metabolic energy release occurs in mitochondria. Eukaryotes have few mitochondria and therefore are less metabolically efficient than prokaryotes which have many.

SEE PAGE 15

26. DIAGRAM 26 illustrates an iguanodon resting on a rock on a hot day in summer.

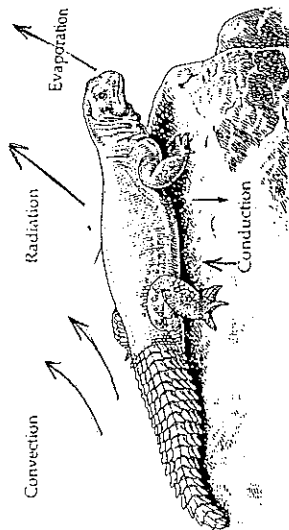


DIAGRAM 26

Which of the following heat transfer processes, affecting the animal, would occur?

	HEAT GAIN BY THE ANIMAL	HEAT LOSS BY THE ANIMAL
(a)	Evaporation	Conduction
(b)	Conduction	Evaporation
(c)	Convection	Radiation
(d)	Evaporation	Conduction

27. How to treat human excretory waste is one of the biggest problems for designers of space capsules in which people can live beyond the atmosphere of earth. Some researchers have tried using cultures of green algae to absorb these excretory wastes. Which of the following is a true statement?

- (a) Algae could usefully absorb carbon dioxide from the atmosphere of a space craft but could not help to solve problems of excretory waste.
- (b) Algae could absorb nitrogenous waste but would release as much carbon dioxide by their respiration as they absorbed by their photosynthesis.
- (c) Cultures of algae could both reduce the level of carbon dioxide in the air as photosynthesis occurs and also convert some nitrogenous waste into biomass.
- (d) Cultures of algae could absorb excretory wastes but only for a short time. Eventually the algal population would produce too much of its own waste products.

SEE PAGE 16



The following information is to be used when answering Questions 28 and 29.

In a complex natural ecosystem different 'trophic levels' occur. DIAGRAM 28 shows arrows to indicate the flow of material and energy between primary producers (P), first order consumers (C<sub>1</sub>), second order consumers (C<sub>2</sub>) and decomposers (D).

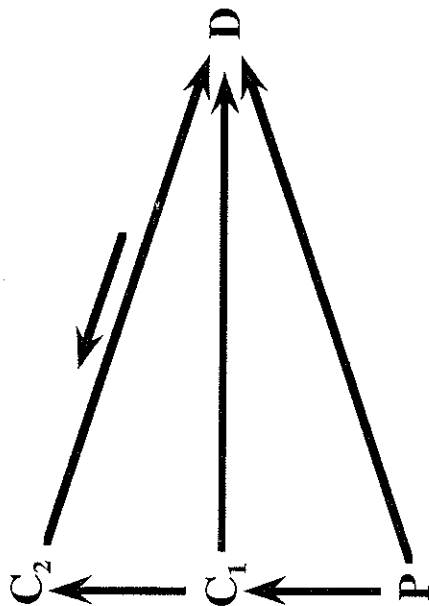


DIAGRAM 28

28. Which of the following would you expect to be true about the relative total biomass at each trophic level?
- P will have the greatest biomass because these organisms convert solar energy to chemical energy.
  - D will have the smallest biomass because these organisms rely on wastes from the other trophic levels.
  - D will have the greatest biomass if the other trophic levels produce minimum waste and debris.
  - C<sub>2</sub> will probably have the least total biomass because these organisms are at the top of the food chain.
29. Which of the following would you expect to be true about the relative amount of new biomass which grows in each trophic level during a one year period?
- The biomass growth in C<sub>2</sub> would be about 1% of that in P.
  - The biomass growth in P would be 10% of that in C<sub>1</sub>.
  - The biomass growth in P would be 10% of that in C<sub>2</sub>.
  - The biomass growth in D would be 10 times that in P.

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30. A large proportion of the rice grown around the world is descended from just a few original parent plants which had high growth rates.
- Which of the following statements is **most likely** to be true?
- The descendants of the original rice plants will quickly adapt to different conditions in different localities.
  - A low level of genetic diversity could make all of the descendants susceptible to the same disease.
  - High levels of rice production can be expected wherever these strains of rice are grown.
  - Isolated populations of rice plants will develop into new species.

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SECTION B

Suggested time: 90 minutes (100 marks)

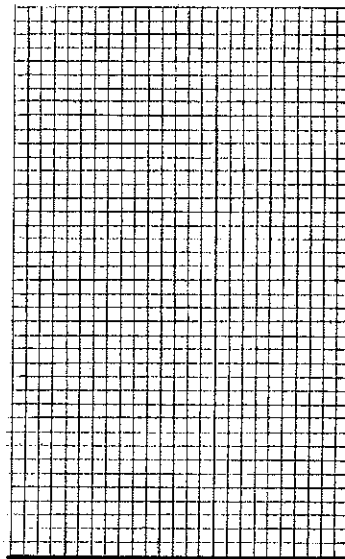
Attempt all questions in this section. Write your answers in the spaces provided. Candidates MUST use a black or blue pen or ball point pen when answering this section.

31. (20 marks)

The following Table shows the consumption of oxygen by goldfish at different temperatures.

TEMPERATURE (°C)	OXYGEN CONSUMPTION (mg O <sub>2</sub> kg <sup>-1</sup> hour <sup>-1</sup> )	
	INACTIVE FISH	ACTIVE FISH
5	11	43
15	72	157
25	200	365
35	322	408

(a) Label each axis drawn below and put units along the scale marks on each axis. (4 marks)



SEE PAGE 19

31. (continued)

(b) Use the axes you have just labelled to graph the data on oxygen consumption by goldfish at different temperatures. (Think carefully about which data should go on which axis of the graph). (4 marks)

(c) Suggest an explanation for the differences in oxygen consumption by inactive fish at different temperatures. (4 marks)

(d) Oxygen consumption is expressed as mg O<sub>2</sub> kg<sup>-1</sup> hour<sup>-1</sup>. Write a sentence explaining why the data are presented in this way. (4 marks)

(e) Use the information given, and the graph that you have drawn, to calculate the amount of oxygen that you would expect to be used by a 500 g fish that was active at a temperature of 20°C. Show how you would make your calculation. (4 marks)

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32. (20 marks)

DIAGRAM 32 shows a section across a salt lake in a part of Australia. The lake is dry in summer and filled with water in winter. This question requires you to think about the energy flow in this system.

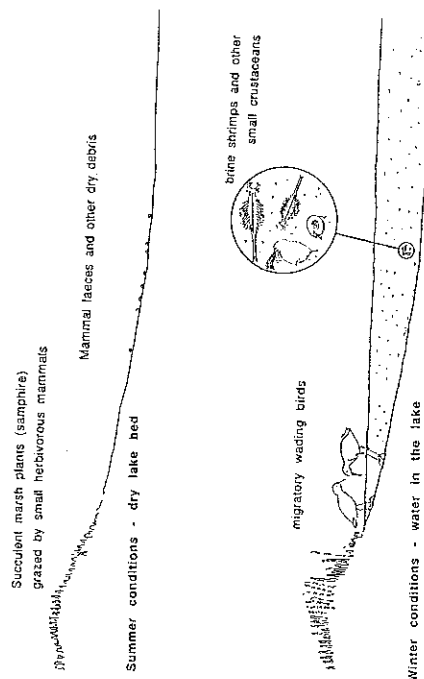


DIAGRAM 32

(a) In this system, which organisms are probably the main primary producers? (2 marks)

(b) Describe a possible energy pathway by which the primary production in summer makes energy available in winter to the brine shrimps and the wading birds. (6 marks)

32. (continued)

(c) It is possible that, during winter, there is primary production by organisms which are unable to function during the summer when the lake is dry. Which type of organisms might these be and where might they occur? (4 marks)

(d) The brine shrimp and other small crustaceans are present in the water of the lake each winter. Suggest two likely explanations for their natural reappearance soon after the lake fills with water. (4 marks)

(e) Explain how this salt lake can be used as an example of how ecosystems in different parts of the world can be interrelated. (4 marks)

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33. (20 marks)

All animals have to maintain a constant body fluid concentration if their tissues are to function efficiently. A delicate balance between inputs and outputs of materials is achieved in different ways by different organisms. Much of the internal functioning depends upon the external environment of an animal.



A freshwater fish has body fluids more concentrated than its surroundings. It is constantly in danger of becoming 'waterlogged'. Careful observation of freshwater fish have shown that they do not drink.

(a) Name **two** ways by which a freshwater fish gains water. (2 marks)

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(b) The kidney can change body fluid concentrations by acting on **two** types of substances. Name these two substances. (2 marks)

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(c) What substance will be strongly reabsorbed by the kidney of a freshwater fish? Explain why this is important. (2 marks)

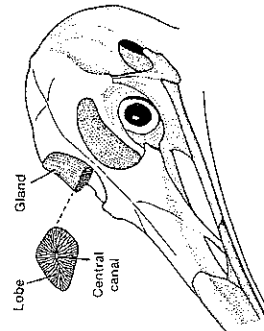
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Marine birds gain excessive amounts of salt from their environment through their food and water. Their body fluids are less concentrated than the sea water they drink.

Many marine birds have special glands in the head which excrete excess salt. The kidneys of marine birds are also efficient at excreting excess or unwanted materials from the body fluids.



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33. (continued)

(d) As well as salt and water, other substances must be removed from the body fluids through the kidney of animals. What are these other substances? (1 mark)

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(e) The chemical form of excretory substances affects the amount of water lost through the kidney of different types of animals. Explain this statement. (3 marks)

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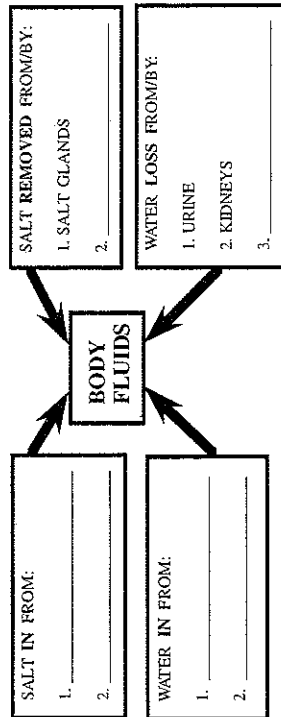


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(f) Complete this flow chart for maintaining body fluid concentrations in a marine bird. (4 marks)



(g) Compare the amount of water lost from the body of similar sized freshwater and marine fish. Explain any differences. (6 marks)

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34. (20 marks)

DIAGRAM 34 shows a plant cell.

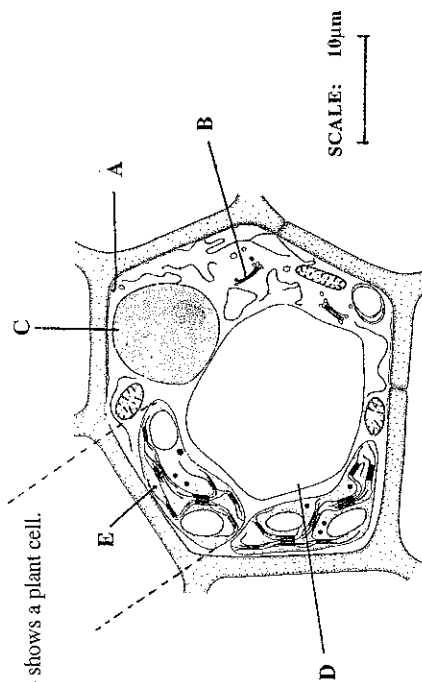


DIAGRAM 34

(a) Name the structures which are labelled as: (4 marks)

A: \_\_\_\_\_

B: \_\_\_\_\_

C: \_\_\_\_\_

D: \_\_\_\_\_

(b) Identify the structure E (indicated by dashed lines) and name the process carried out by this structure. (2 marks)

(c) Name the instrument used to show the cell details given in DIAGRAM 34. (2 marks)

(d) i) Estimate the diameter of the cell in DIAGRAM 34. (4 marks)

ii) Calculate how many of those cells would fit across a field of view, with diameter **1.8 mm**, of a microscope.

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34. (continued)

(d) iii) Estimate the length of structure E in DIAGRAM 34.

(e) Name **two** cell structures visible in DIAGRAM 34 that you would **not** observe in an illustration of similar magnification of an animal cell. (2 marks)

(f) i) If the cell were permitted to undergo three non-sexual divisions, how many daughter cells would there be? (2 marks)

ii) Name **two** locations in a plant where this type of cell division occurs. (2 marks)

iii) Would you expect genetic differences between the daughter cells and original mother cell? Briefly explain your answer. (2 marks)

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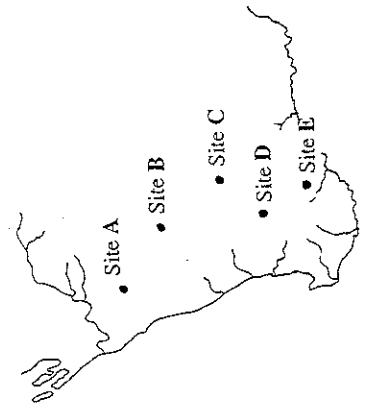
35. (20 marks)

Granite outcrops, as illustrated in DIAGRAM 35A, for example, are conspicuous features throughout the southwest of Western Australia.



DIAGRAM 35A

A botanist was interested in determining the genetic structure of populations of a shrub which is restricted to the soils in a very narrow zone around the base of the outcrops. The botanist collected material from five sites (see map, DIAGRAM 35B), and determined the frequencies of two genes as follows.



	GENE H		GENE Q	
	H	h	Q	q
Site A	0.09	0.91	0.53	0.47
Site B	0.14	0.86	0.14	0.86
Site C	0.52	0.48	0.71	0.29
Site D	0.61	0.39	0.68	0.32
Site E	0.79	0.21	0.33	0.67

DIAGRAM 35B

(a) What name is given to the alternative states of any gene, for example **H** and **h** above? (1 mark)

35. (continued)

(b) What is the name given to the process whereby **H** might change to **h** or *vice versa*? (1 mark)

(c) Name **two** environmental factors which might limit the distribution of these plants. (2 marks)

(d) Consider just gene **H**.  
i) Is there a pattern in the frequency of **h** between the five sites? If there is, describe it briefly. (2 marks)

ii) What genetic process might be responsible for the different frequencies of the two forms of gene **H** noted at the five sites. (1 mark)

iii) Explain how **one** environmental factor given in your answer to part (c) might cause the distribution of frequencies of gene **H**. (4 marks)

35. (continued)

(e) Consider just gene Q.

- i) Is there a pattern in the frequency of **q** between the five sites? If there is, describe it briefly.

(2 marks)

- ii) What genetic process might be responsible for the different frequencies of the two forms of gene **Q** noted at the five sites.

(1 mark)

- (f) Suppose that you are given the task to rehabilitate a land site around a granite outcrop with a population of these plants. From which of the five populations would you select seeds in order to produce a population with maximum genetic diversity. Explain.

(4 marks)

- (g) Suggest a sound biological reason for preserving an area including a granite outcrop in a National Park.

(2 marks)

## SECTION C

Suggested time: 50 minutes (40 marks)

## USE THE SEPARATE ANSWER BOOK FOR SECTION C ANSWERS

There are two questions in this section: 36 and 37, each with two alternatives.

Twenty marks are allocated for each answer.

Concisely worded statements are expected for each answer. Where it is appropriate, answers should be supported with clear, labelled diagrams. Marks may be deducted for answers which are poorly presented or difficult to read. Candidates must use a black or blue pen or ball point pen when answering this section.

36. EITHER

- (a) Animals and plants can both make a variety of responses to environmental stimuli. Some responses are fast, some are slow.

- i) Give an example of a rapid response made by a named plant.

(2 marks)

- ii) Describe in detail the process involved when a plant responds to light shining from one side.

(8 marks)

- iii) Give an example of an environmental stimulus which may produce rapid responses and an example of a stimulus producing slow responses in a named animal.

Describe in detail the steps involved in the animal's responses to these stimuli.

(10 marks)

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36. (continued)

OR

- (b) DIAGRAM 36b shows regions of the alimentary canal of some different mammals. These animals mainly eat plant tissues with a large proportion of cellulose. The animals cannot make direct use of cellulose as food because they do not produce the necessary digestive enzyme. Specialised regions of the alimentary canal of these animals contain populations of bacteria, fungi and other micro-organisms. These organisms are able to use cellulose as a source of energy and the mammals benefit from this.

- Explain the meaning of the term 'enzyme' and why an enzyme is required before cellulose can be used as food. (4 marks)
- Different enzymes function best in different conditions. Explain how the conditions within the alimentary canal of these mammals might be ideal for effective enzyme action. (4 marks)
- Very little oxygen is available in the environment where these micro-organisms live. Explain how this affects their cellular metabolism and how the mammals are able to benefit from their presence. (8 marks)
- An association with internal micro-organisms is an important aspect of the biology of large plant-eating mammals. Explain how the illustrations in DIAGRAM 36b give evidence that the associations are very important. (4 marks)

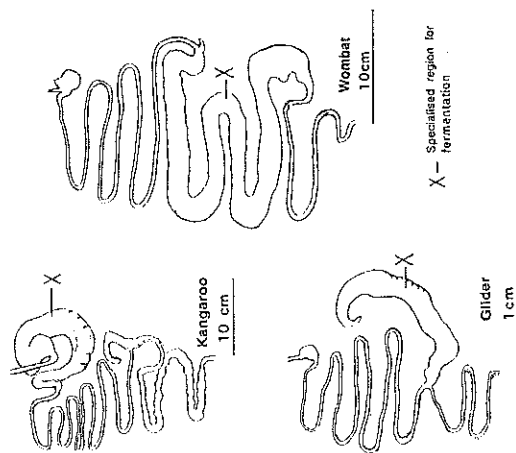


DIAGRAM 36b

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37. EITHER

- (a) Many estuaries, including the Swan-Canning and Peel-Harvey estuaries in Western Australia, have been affected by algal blooms during recent years. An estuary is a zone where river water and sea water mix together under the influence of tides and wind. The Peel-Harvey estuary is shown in DIAGRAM 37a. Shaded areas in the diagram show the extent of algal blooms.

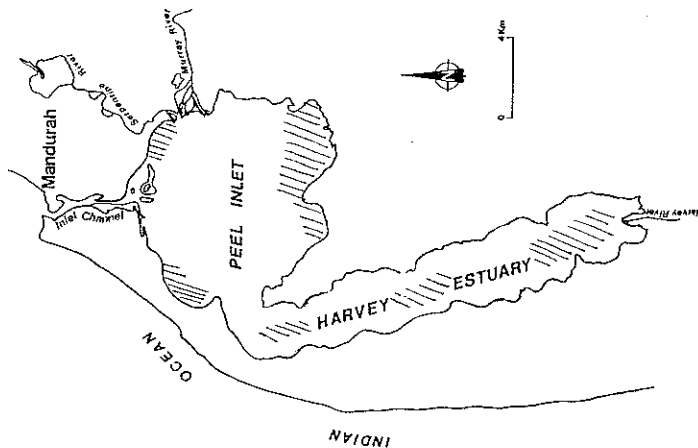


DIAGRAM 37a

- Explain how each of the following factors may play a part in the development of an algal bloom: (10 marks)
  - salinity
  - nutrient load in river and run-off water
  - temperature
  - water flow
  - light
- Explain how the quality of water in rivers can be affected by patterns of land use in surrounding rural OR urban areas. (10 marks)

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37. (continued)

OR

- (b) One of the great problems for Western Australian wheat farmers is the ever-present threat of 'rust' attacking the wheat crop.
- 'Rust' is a fungal disease which damages the base of the wheat stalk, causing the seed head to fall over and rot. The disease reduces the harvest considerably, especially when there is wet weather near the end of the growing season. Members of the government scientific research organisation, CSIRO, have been actively involved in finding or developing wheat strains to resist 'rust'. Several resistant strains have been developed, but after a few years they too become susceptible to rust.
- Explain how weather conditions may affect the extent of damage by rust. (2 marks)
  - A strain of wheat which resisted rust was successfully grown. Because wheat is a self-pollinator, all of the seeds produced by this strain had the resistance. Describe the process which might have been used by scientists to produce the rust resistant strain of wheat. (4 marks)
  - Describe the process that occurs in the wheat plant which passes rust resistance from one generation to the next. (6 marks)
  - A farmer was very careful to plant only seeds obtained from a known strain of rust resistant wheat and had four successful harvests. In the fifth year, the crop was badly affected by rust. Explain how this might have occurred. (8 marks)



Wheat stem affected by rust.

THE END

## ACKNOWLEDGEMENTS

- Q5. Figure 5 was adapted from Campbell, N. A. (1990). *Biology*. P 915, 2nd edition. Benjamin/Cummings Publishing Company, Incorporated, California.
- Q13. Williams, J. (ed.) (1977). *Higher School Certificate Biology: Exam Questions with Answers and Explanations*. Clearway Textbooks, Strathfield, New South Wales.
- Q15. The Table from Erichsen Jones, J. R. (1964). *Fish and River Pollution*. P160. Butterworth's Scientific Publishers, London.
- Q21. Williams, J. (ed.) (1977). *Higher School Certificate Biology: Exam Questions with Answers and Explanations*. Clearway Textbooks, Strathfield, New South Wales.
- Q23. The Figure from Evans, B. K., Ladiges, P. Y. & J. A. McKenzie (1991). *Biology Two: Survival Mechanisms and Change*. P22. Heinemann Educational Australia.
- Q26. Figure 26 was adapted from Campbell, N. A. (1990). *Biology*. P 894, 2nd edition. Benjamin/Cummings Publishing Company, Incorporated, California.
- Q33. Figure of the galaxiid from Lake, J. S. (1971). *Freshwater Fishes and Rivers of Australia*. P20. Thomas Nelson (Australia) Ltd, Melbourne.
- Q34. Figure of the bird from Eckert, R. & D. Randall (1983). *Animal Physiology: Mechanisms and Adaptations*. P528. W. H. Freeman and Company, San Francisco (who acknowledge the source of Schmidt-Nielsen, 1960).
- Q34. Figure 34 from Morgan, D. (ed.) (1989). *Biological Science: The Web of Life*. Part II, p477. Australian Academy of Science, Canberra.
- Q35. Photograph of the granite outcrop by Dr D. H. D. Edward.
- Q37. Photograph of rust from Loughman, R. (1994). *Identifying Wheat Leaf Diseases*. Department of Agriculture, Bulletin 4287, p7.