

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 of paper: Three hours

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

See Page 2

FOR EXAMINER'S USE ONLY							
Section	Qu. No.	1st mark	2nd mark	Section	Qu. No.	1st mark	2nd mark
A	1-40			C	46a		
	41				46b		
	42				46c		
	43				47a		
	44				47b		
B	45				47c		
	Sub Total B			Sub Total C			

Total	1st mark =	2nd mark =	Final Total =
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MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPERTO BE PROVIDED BY THE SUPERVISOR

This Question/Answer Booklet comprising 39 pages and 47 questions
One piece of blank paper for rough work
A Separate Multiple Choice Answer Sheet

TO BE PROVIDED BY THE CANDIDATEStandard Items

Pens, pencils, eraser, ruler

Special Items

A 'B' or '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.

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/ANSWER BOOKLET.

Attempt all questions in Section A on the Separate Multiple Choice Answer Sheet, which will be collected separately by the Supervisor.

Use a 'B' or '2B' PENCIL. DO NOT use a ball point or ink pen.

Marks are not deducted for wrong answers.

Answer Sections B and C in the places provided in the question paper. Draw graphs in pencil before inking in the lines.

You are provided with a piece of blank paper for rough work.

DO NOT copy the question when writing an essay (Section C). Merely write the number of the question in the margin.

Use a blue or black PEN (not pencil) when answering Sections B and C.

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

SEE PAGE 3

SECTION A

Suggested time: 60 minutes (40 marks)

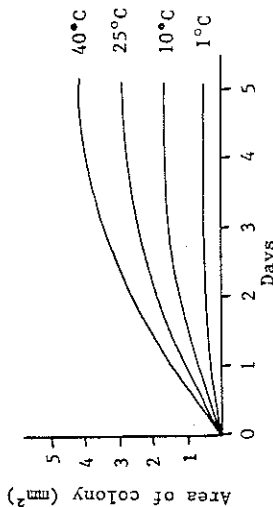
Record each answer for questions 1-40 by marking your choice of alternatives on the Separate Multiple Choice Answer Sheet using a "B" or "2B" pencil.

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

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

1. A small, flat, green plant without stem or root is found growing along the banks of a stream. It is attached loosely to the soil by rhizoids and is most probably
 - A. an alga
 - B. a cactus
 - C. a liverwort
 - D. a lichen
2. Which of the following objects is least likely to be termed radially symmetrical?
 - A. saucer
 - B. jam jar
 - C. hen's egg
 - D. coffee cup

3. A particular species of bacteria is normally found in bottled milk. Colonies of this species were grown on an agar medium at different temperatures in order to measure rates of growth. The following results were obtained:



It would be reasonable to conclude from the graph that

- A. growth reaches a maximum at 5 days
- B. these colonies have a maximum size of 4 mm² area
- C. the area of a colony does not depend on temperature
- D. milk infected by this bacterium is best kept in the refrigerator

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4. When first studying *Hydra*, an investigator thought that it was a plant. He would have changed his mind when he found that *Hydra*
- could reproduce sexually
 - produced motile gametes
 - produced buds
 - took in organic material
5. Which of the following experimental procedures would serve best to determine the effectiveness of inoculating sheep against anthrax disease?
- Expose 50 sheep to anthrax and then inoculate all of them
 - Inoculate 25 out of 50 sheep and then expose all 50 to anthrax
 - Inoculate 50 sheep and then expose all of them to anthrax
 - Inoculate 25 out of 50 sheep and then expose only the inoculated sheep to anthrax
6. Which of the following comparisons between insect- and wind-pollinated flowers is NOT true?
- | Wind-pollinated flowers | Insect-pollinated flowers |
|-----------------------------|---------------------------|
| A. flowers often colourless | flowers often coloured |
| B. pollen light and small | pollen heavier and sticky |
| C. flowers odourless | flowers scented |
| D. stigma small and simple | stigma large and feathery |
7. Relatively few endothermic animals are found living in water. Endothermy is probably a greater advantage to a land-living animal than to an aquatic animal because
- air temperatures fluctuate more widely than water temperatures
 - air temperatures are generally higher than water temperatures
 - land-living animals can grow to a greater size than water-living animals
 - few water-living animals need to keep warm
8. Which of the following features is most likely to be present in an angiosperm which lives submerged in water?
- a thick stem
 - an extensive root system
 - thin leaves
 - conspicuous flowers

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9. A student carried out an experiment using cellulose tubing which was permeable to monosaccharides but not to polysaccharides. He filled one cellulose tube with a concentrated solution of starch and placed it in beaker A containing water and iodine. A second cellulose tube filled with glucose solution was also placed in a beaker of water (beaker B) to which iodine was added. The beakers were then left overnight.
- Where would it be expected that a blue-black colour would be found?
- In the water of beaker A but not within the contained tube
 - Within the tube of starch but not in the surrounding water
 - In both the starch and the glucose-filled tubes but not in the surrounding water
 - Neither in the tube nor in the surrounding water of either beaker A or B
10. Adult flounders live on one side on sandy sea beds. They have two eyes, but both are on the same side of the body. Which of the following best describes the probable origin of this adaptation?
- The animals live in the sand and eyes on both sides of the head are not needed
 - Over a long period of time some mutant flounders had eye positions which were not symmetrical and the fish which had both eyes on top survived in greater numbers than the others
 - The eye on the sandy side was not needed and disuse in the dark caused the eye to rotate towards the light in the embryonic stages
 - Evolution caused the position of the eye to change so that the flounder was best suited to its environment
11. Which of the following is not a necessary part of the explanation of the theory of water transport in a plant?
- The ability of the plant to take up water even when its roots have been removed
 - The strong forces of attraction between water molecules
 - The negative pressure found in the xylem vessels
 - The presence of a continuous column of water found in the xylem vessels
12. Many endothermic animals become dormant or hibernate when the environmental temperature is low or the food scarce. The usual consequence of this is that
- food reserves are used up and the animals die
 - the animals become dehydrated as they can no longer take in water
 - their body temperature falls below the normal set point
 - their body temperature remains at the normal set point as the animals are endotherms

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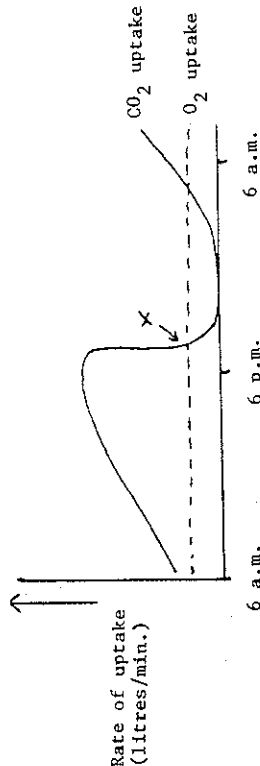
14. In which age class are plants probably most affected by lack of light?

- A. less than 2 years
- B. 2-4 years
- C. 4-10 years
- D. none is affected

15. From the tables it appears that the presence of adult trees around seedlings may influence their chances of survival by

- A. covering them with leaf litter
- B. utilizing their water supply
- C. limiting the amount of light they receive
- D. all of the above factors

16. The graph below shows the rate of uptake of oxygen and carbon dioxide by a plant over a 24-hour period.



At point X on the graph

- A. the respiration rate is greater than the photosynthetic rate
- B. the carbon dioxide uptake is greater than the oxygen uptake
- C. both respiration and photosynthesis are increasing
- D. oxygen uptake and carbon dioxide uptake are in equilibrium

17. It has been found experimentally that mice and dogs can breathe water instead of air, provided that certain conditions are met. Which combination of two of the following conditions should prove to be most practical in achieving the above result?

- I. Put the lungs on the outside of the body
- II. Greatly increase the amount of oxygen in the water
- III. Have the water at the same osmotic pressure as the blood
- IV. Change the shape of the lungs so that they are like gills

- A. I and IV
- B. II and IV
- C. II and III
- D. III and IV

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Questions 13, 14 and 15 are based on the following information: In a number of surveys of seedling survival in an Australian forest community, the data in the following tables were obtained.

Table 1: Ages of Seedlings Damaged by Browsing Animals

DATE	Age of Seedlings		
	Less than 2 years	2-4 years	4-10 years
April, 1963	5	9	-
June, 1963	1	2	-
September, 1963	-	3	-
December, 1963	4	4	1
March, 1964	12	20	2
June, 1964	1	3	-
September, 1964	2	1	-
TOTAL	25	42	3

Table 2: Ages of Seedlings Dying from Lack of Water

DATE	Age of Seedlings		
	Less than 2 years	2-4 years	4-10 years
April, 1963	4	7	1
June, 1963	1	1	-
September, 1963	-	-	-
December, 1963	-	-	-
March, 1964	-	1	-
June, 1964	8	8	1
TOTAL	13	17	2

Data were also collected on the effect of leaf litter on seedlings as shown in the following table:

Table 3: Fates of Seedlings Covered by Leaf Litter

CONDITION	Age of Seedlings		
	Less than 2 years	2-4 years	4-10 years
Dead	17	5	-
Alive, but pale and spindly	2	1	(too tall to be covered)
Alive, but no new shoots	-	1	-
Healthy, with new shoots	2	3	-
TOTAL	21	10	-

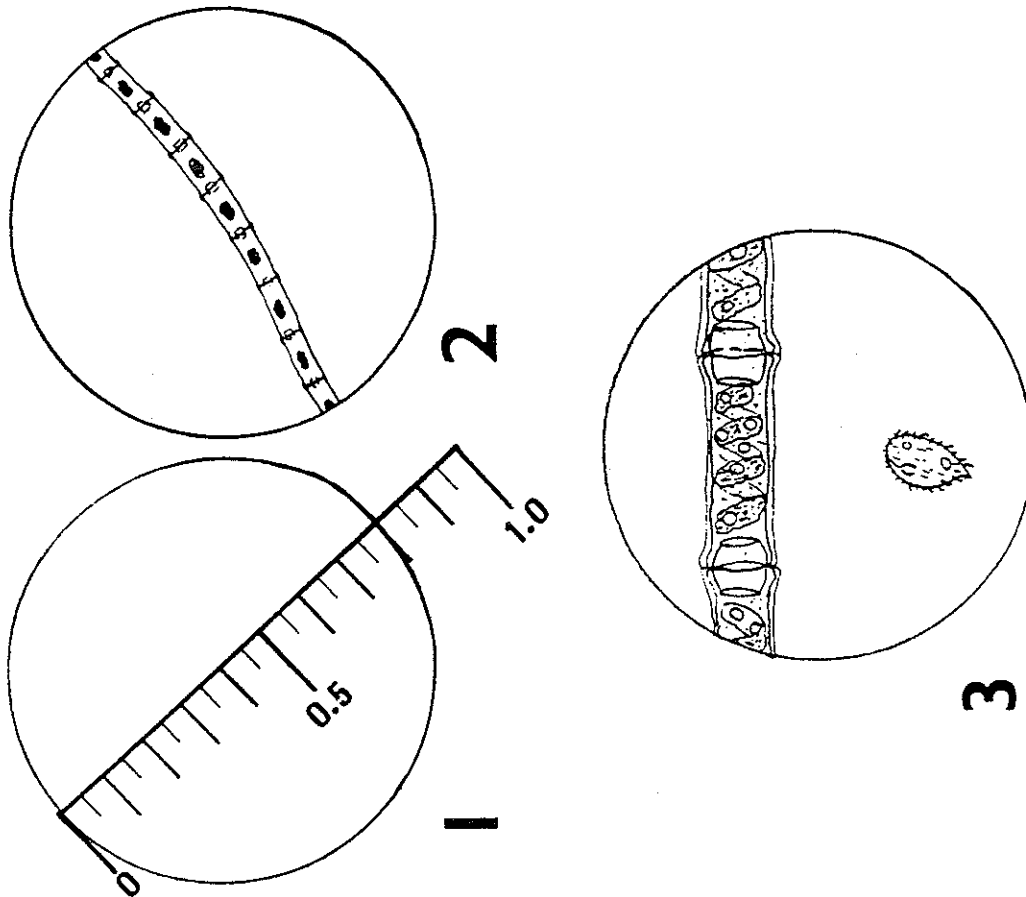
13. In which age class are plants most susceptible to lack of water?

- A. less than 2 years
- B. 2-4 years
- C. 4-10 years
- D. all are equally susceptible

SEE PAGE 7

Questions 18 and 19 are based on the following information.

Each of the drawings below is of the whole field of view as seen with a monocular microscope. The lens combination, X15 ocular and X10 objective, was used to make drawings 1 and 2 whilst a higher magnification was used for drawing 3. Drawing 1 shows a 1 mm scale superimposed on the field of view. Drawings 2 and 3 are of the same filament of an alga, *Spirogyra*.



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18. The diameter of the field of view in 3 would most closely approximate to

- A. 200 μm
- B. 350 μm
- C. 0.5 mm
- D. 3.5 mm

19. The most likely number of cells per metre of filament of this species of *Spirogyra* would be

- A. 10
- B. 100
- C. 1,000
- D. 10,000

20. Aerobic respiration releases more energy for use by an organism than anaerobic respiration because

- A. oxygen is a requirement for aerobic respiration but not for anaerobic respiration
- B. aerobic respiration results in a more complete breakdown of glucose than anaerobic respiration
- C. the process of aerobic respiration requires more energy for its completion
- D. a by-product of aerobic respiration is carbon dioxide while that of anaerobic respiration is alcohol or lactic acid

21. A type of toadstool, *Mycena* sp., which grows in Japan has been found to be luminous. The total amount of energy emitted as light from such a toadstool would be

- A. more than the total amount taken in from the environment
- B. equal to the total amount taken in from the environment
- C. less than the total amount taken in from the environment
- D. equal to the amount of energy used in photosynthesis

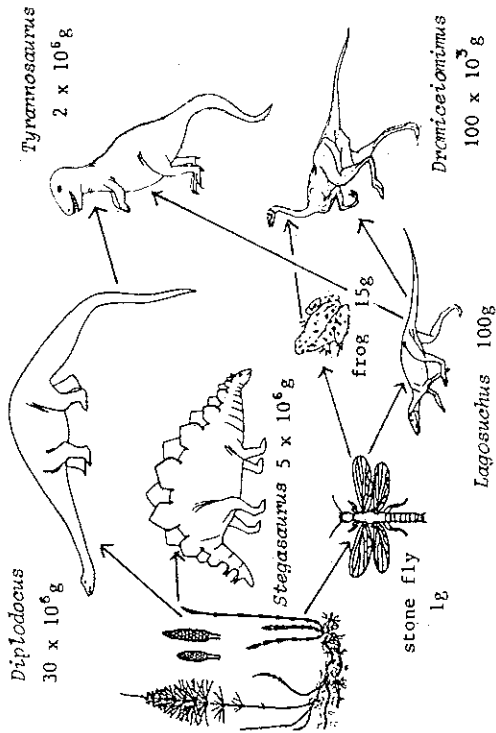
22. One of Mendel's experiments involved crossing pure-breeding peas having yellow seeds with pure-breeding peas having green seeds. All the seeds from this cross were yellow. On planting these yellow seeds and allowing the plants to self-fertilise, 6022 yellow seeds and 2001 green seeds were obtained.

Mendel planted some of these 6022 yellow seeds and allowed the resulting plants to self-fertilise. What results should have been expected from this final experiment if a large number of seeds was produced by each plant?

- A. 1/3 of the plants produced only yellow seeds and 2/3 of the plants produced both yellow and green seeds
- B. 1/4 of the plants produced only yellow seeds and 3/4 of the plants produced both yellow and green seeds
- C. all plants produced yellow seeds
- D. all plants produced green seeds

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23. The diagram below shows a possible food web from the Mesozoic era.



Normally the most common animal in the community would be

- A. *Diplodocus*
- B. frog
- C. stone fly
- D. *Dromiceiomimus*

24. The prokaryotic organisms consist of

- A. bacteria and blue-green bacteria
- B. bacteria, other unicellular life, and fungi
- C. viruses
- D. all organisms with a distinct nucleus

25. A plant has a diploid chromosome number of 18. The haploid number of one of its pollen grains would be

- A. 36
- B. 9
- C. 18
- D. Pollen grains do not have the haploid number of chromosomes

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Question 26 is based on the following table:

	Organism I	Organism II	Organism III	Organism IV
Phylum	Chordata			
Class	Aves			
Order	Passeriformes	Pelecaniformes		
Family	Meliphagidae	Phalacrocoracidae		
Genus	<i>Anthochaera</i>	<i>Phalacrocorax</i>	<i>Anthochaera</i>	<i>Meliphaga</i>
Species	<i>chrysoptera</i>	<i>varius</i>	<i>carunculata</i>	<i>virescens</i>

26. Which two organisms are most closely related?

- A. I and II
- B. II and III
- C. I and IV
- D. I and III

Questions 27 and 28 are based on the following information.

A certain grasshopper species is able to change colour when placed on a differently coloured background. This takes 2-3 days. In parts of Australia this is particularly noticeable when the insects turn black in burned areas. An entomologist studying this problem divided a sample of green grasshoppers into three groups and treated them as follows: Group A she placed in a cage with a black background. Groups B and C were also placed in black cages after removal of an internal body organ, the corpus allatum.

After 3 days all group A grasshoppers were black while the others were still green. The entomologist then injected a corpus allatum extract into group C insects. Three days later the latter had also turned black while those in group B were still green.

27. A likely explanation for the results would be

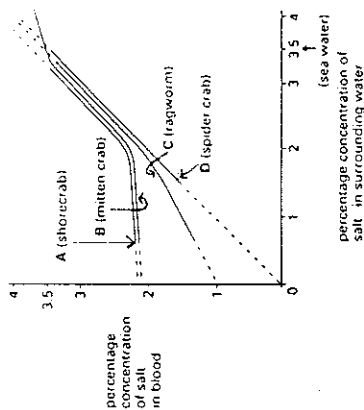
- A. the corpus allatum detects changes in the background colour
- B. colour change is caused by a hormone produced in the corpus allatum
- C. surgery interferes with the ability to change colour
- D. the corpus allatum is not involved in colour change

28. If group A grasshoppers were placed back on a green background you would expect them to

- A. turn green
- B. remain black
- C. turn green only if injected with corpus allatum extract
- D. die

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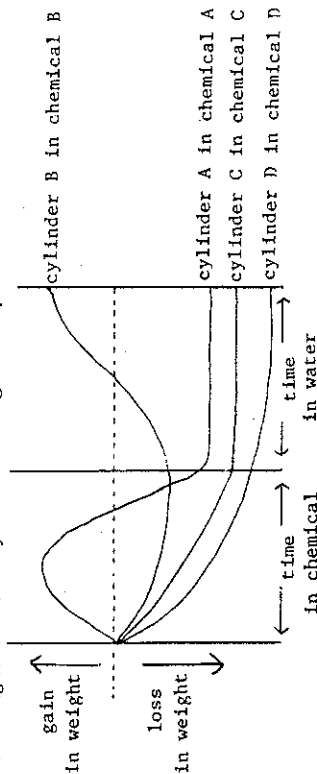
Question 32 is based on the following graph which shows the variation in salt concentration of the body fluid of four invertebrates when they were placed in different dilutions of sea water.



32. Which animal is completely unable to maintain a blood concentration of salt above that in the surrounding water?

- A. Animal A
- B. Animal B
- C. Animal C
- D. Animal D

Question 33 is based on the following information: Four cylinders of tissue were cut from a potato. Each cylinder was immersed in a different chemical for a time and then was placed in water. The following graph shows the change in weight of each cylinder during the experiment.



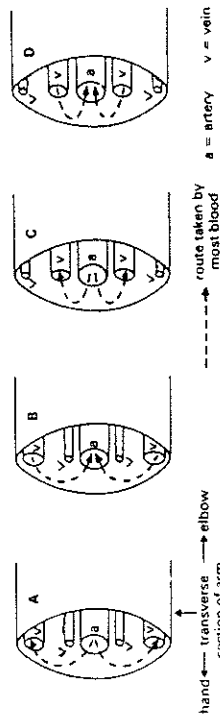
33. Which chemical was NOT toxic to the selectively permeable membranes of the potato cells?

- A. Chemical A
- B. Chemical B
- C. Chemical C
- D. Chemical D

29. What purpose does a control serve in an experiment?

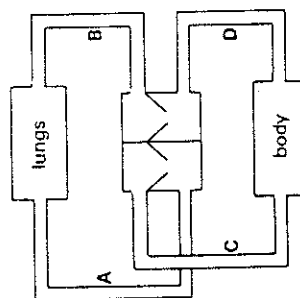
- A. The control ensures against error in performing the experiment
- B. The control makes it possible to test several variables at one time
- C. The control serves as a replicate experiment
- D. It provides a standard for comparison, thus increasing the validity of the interpretation of the results

30. Which of the following diagrams shows the correct route of blood flow in a human arm exposed to extremely cold environmental conditions?



- A. Diagram A
- B. Diagram B
- C. Diagram C
- D. Diagram D

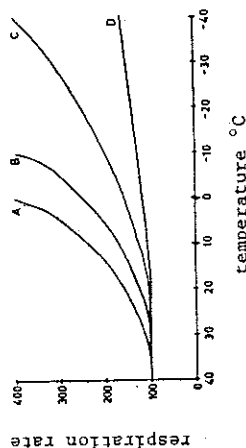
31.



The above diagram shows a type of circulatory system. Which vessel contains deoxygenated blood at high pressure?

- A. Vessel A
- B. Vessel B
- C. Vessel C
- D. Vessel D

Questions 34 and 35 are based on the following information: Four different endotherms, A, B, C and D, were tested in the laboratory to determine which was best adapted to prolonged cold conditions. The rate at which each animal respired, thus producing heat, was measured while the temperature of the air around the animal was being lowered.



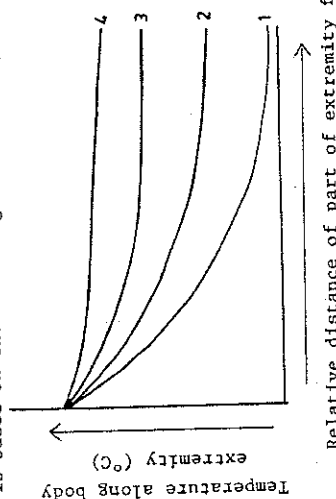
34. Which animal would have the best insulating layer?

- A. Animal A
- B. Animal B
- C. Animal C
- D. Animal D

35. Which animal would eat more during a period of prolonged cold?

- A. Animal A
- B. Animal B
- C. Animal C
- D. Animal D

Question 36 is based on the following information plus the graph from Qs 34/35.



The graphs above illustrate the changes in temperatures along body extremities, e.g. noses, legs and beaks, when each animal was placed in an air temperature of -15°C .

36. Animal A would probably have a graph similar to

- A. graph 1
- B. graph 2
- C. graph 3
- D. graph 4

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37. Experiments were conducted to determine the influence of hormones from two endocrine glands, X and Y, on the change from tadpole to adult (metamorphosis) in amphibians. Destruction of either gland X or of gland Y prevented metamorphosis but when Y was destroyed, gland X remained small and inactive.

To further elucidate the effects of gland Y on metamorphosis, the most reasonable procedure would be to

- A. supply hormone X and note the effects on gland Y
- B. remove gland Y and increase the supply of hormone X, and note the results
- C. supply an increased quantity of hormone Y and note the results
- D. remove glands X and Y and note the results of supplying both hormones X and Y

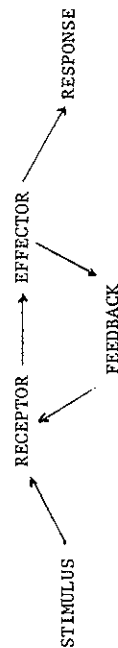
38. Many inhabitants of Central America subsist largely on a diet of corn with perhaps the addition of beans. People living on such a diet tend to become lethargic and lack an appetite for food. You have been asked to recommend one of the following breads as a supplementary food source for Central American peasants.

Type	Proteins (%)	Fats (%)	Carbohydrates (%)
White Bread I	20.0	2.4	38.4
White Bread II	7.4	3.2	62.5
Brown Bread III	10.7	1.3	47.8
Cornmeal Bread IV	5.8	2.4	50.7

Having regard to the dietary needs of the people, you would recommend

- A. bread I as it contains most protein
- B. bread II for its high-energy constituents
- C. bread III because brown bread has vitamins
- D. bread IV because cornmeal is readily available

39. The following diagram shows the stimulus-response system:

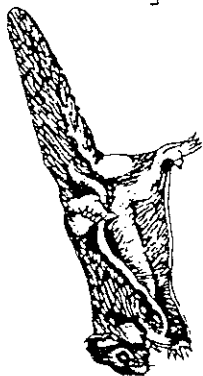


Which of the following would NOT involve feedback to the receptor?

- A. level of blood glucose after a meal
- B. blinking when a cinder enters the eye
- C. reducing the size of the eye pupil when light intensity increases
- D. control of breathing rate by the level of CO_2 in blood

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40.



10 cm

1. Tail absent	Koala (<i>Phascolarctos</i>)
2. Tail present	2 Honey possum (<i>Tarsipes</i>)
3. Muzzle very long and pointed	3
4. Muzzle short	4
5. Tail naked and scaly at tip	5
6. Tail tip hairy at least on upper surface	6
7. Whole tail naked all round	7 Scaly-tailed possum (<i>Hydula</i>)
8. Tip of tail naked all round	8 Cuscus (<i>Phalanger</i>)
9. Tail feather-like with stiff fringe on each side	9 Feather-tailed glider (<i>Aerobates</i>)
10. Tail not feather-like	10 Striped possum (<i>Dactylopsila</i>)
11. Head and body with black and white stripes	11
12. Head and body not striped with black and white	12
13. Tail tip fully haired all round	13
14. Tail tip naked on under side	14
15. Gliding membrane present	15 Glider (<i>Petaurus</i>)
16. Gliding membrane absent	16 Leadbeater's possum (<i>Gymnobelideus</i>)
17. Tail thinly haired and tapering	17
18. Tail bushy	18
19. Head-body length about 10 cm	19 Pigmy possum (<i>Cercartetus</i>)
20. Head-body length about 40 cm	20 Ring-tailed possum (<i>Pseudocheirus</i>)
21. Gliding membrane present	21 Greater glider (<i>Scolothobates</i>)
22. Gliding membrane absent	22
23. Naked area on under side of tail extending from tip to half-way up tail	23 Brush-tailed possum (<i>Trichosurus</i>)
24. Naked area on under side of tail extending less than a quarter of the way up tail	24 Lemuroid ring-tailed possum (<i>Hemibelideus</i>)

From the above key, the marsupial shown would belong to the genus

- A. *Dactylopsila*
 B. *Trichosurus*
 C. *Petaurus*
 D. *Scolothobates*

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SECTION B

Suggested time: 75 minutes (36 marks)

Attempt all questions in this section.

Write your answers in the spaces provided.

41. (7 marks)

A firm of agricultural consultants was hired by a plant nursery to evaluate a new potting mix for growing vegetables and a new all-purpose fertiliser. The following experiment was set up.

Treatment A: 10 tomato seeds were planted in the old potting mix and fertilised with the old fertiliser.

Treatment B: 10 tomato seeds were planted in the new potting mix and fertilised with the new fertiliser.

Both treatments were kept under identical conditions in a glasshouse and the height of each seedling was measured after 4 weeks. The results were:

Average height of seedlings

Treatment A	26 cm
Treatment B	35 cm

The consultants concluded that the new potting mix and the new fertiliser were superior to the old ones.

(a) Explain three flaws in the experimental design.

(b) How would you set up an experiment to test the new potting mixture?

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42. (9 marks)

An experiment on the effects of temperature on the rate of photosynthesis was carried out on two different aquatic plants. The number of bubbles given off by each plant during one minute was counted. Each count was repeated three times at each different temperature and the average results are shown in the following table.

Temperature (°C)	Average number of bubbles per minute Plant A	Plant B
5	4	13
10	10	27
15	22	65
20	43	97
25	60	123
30	66	133
35	30	138
40	0	120

(a) Plot the data on the graph on page 19.

(b) (i) What is the general relationship between temperature and the rate of photosynthesis?

(ii) Explain how the graph tells you about this.

(c) From the graph find out the rate of photosynthesis of plant A and plant B at 28°C.

Plant A _____ Plant B _____

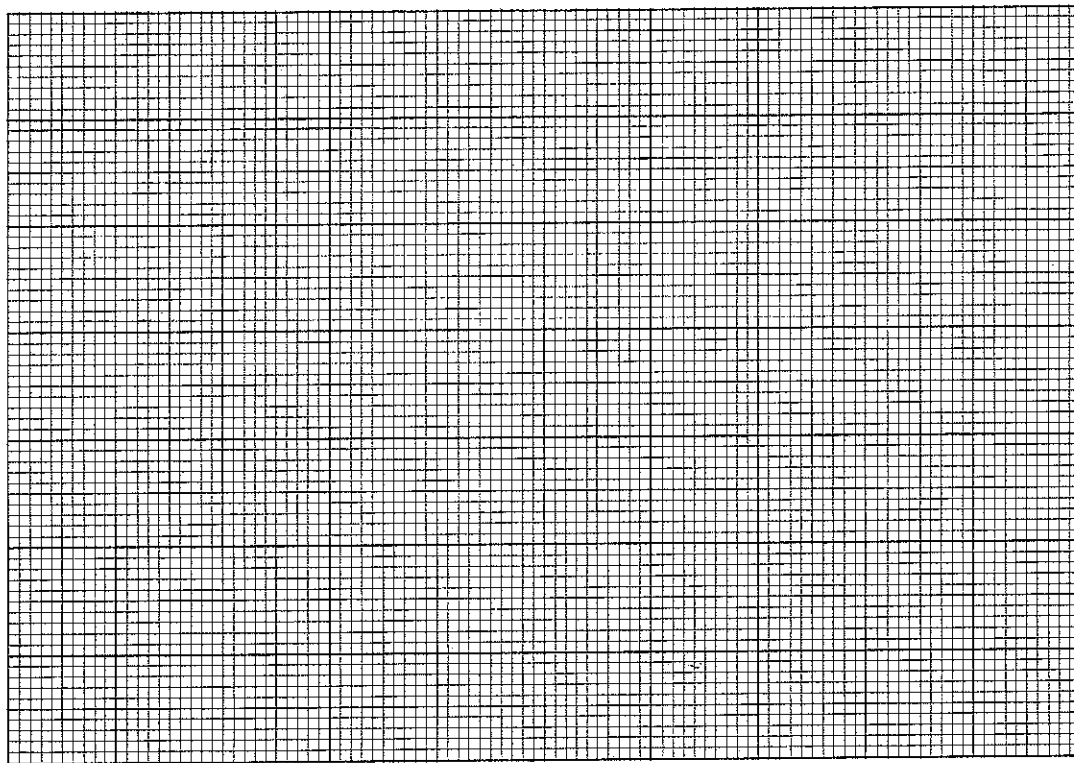
(d) How do the two plants differ with respect to

(i) tolerance to high temperatures? Give reasons for your answer.

(ii) optimal temperature for photosynthesis?

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42. (continued)



(The spare graph paper on page 39 may be used if you spoil this one)

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43. (9 marks)

Animals can be described as having roughly spherical bodies with projections for locomotion. The following table gives the radius, surface area and body volume of each of five animals.

	Animal				
	A	B	C	D	E
radius (cm)	0.5	2.0	4.0	5.0	10.0
area (cm ²)	3.13	50.2	200.8	313.0	1252.0
volume (cm ³)	0.52	33.6	268.8	523.8	4190.4

It is known that while surface area increases as the square of the radius, volume increases as the cube of the radius. The gain and loss of heat and chemical substances involved in metabolism must take place across a surface. Small organisms, such as protozoans and single-celled plants, are roughly spherical in shape, though they may have flagella, cilia or pseudopods for locomotion. On the other hand, higher plants have a branching body form.

(a) How do you explain this difference in body form between small and large plants in view of the facts stated above and your knowledge of the metabolic processes of plants?

(b) How would you expect the metabolism of a typical cactus to differ from that of a leafy shrub? Explain.

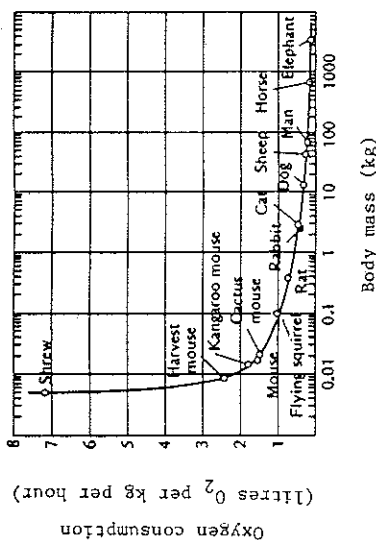
(c) What problems, related to the extended surface area, does the branching body form create for terrestrial plants (particularly those in dry environments)?

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43. (continued)

(d) How are the problems listed in (c) overcome?

(e) Semi-log graph showing rates of oxygen consumption of various mammals as an indication of their metabolic rates



Man consumes about 800g of food per day. Bearing in mind the relative sizes and metabolic rates of man and the flying squirrel, approximately how much food would you expect a flying squirrel to consume per day?

(f) The smallest known mammals are shrews of about 5g body weight. What do you think is likely to impose a lower limit to the size of a mammal? Explain your answer.

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44. (continued)

(a) (i) Does this cell come from a plant or an animal?

(ii) Explain your answer to (i).

(b) If this cell was placed in a salt solution which was of higher concentration than sea water, what changes would you expect to occur?

(c) In a very active cell, which of the structures labelled A-F would be more numerous than is shown in Figure 1?

(d) If this cell had come from the spongy mesophyll region of a green plant, what additional features would be present in the total diagram?

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44. (6 marks)

Figure 1 shows a cell as seen through the electron microscope.

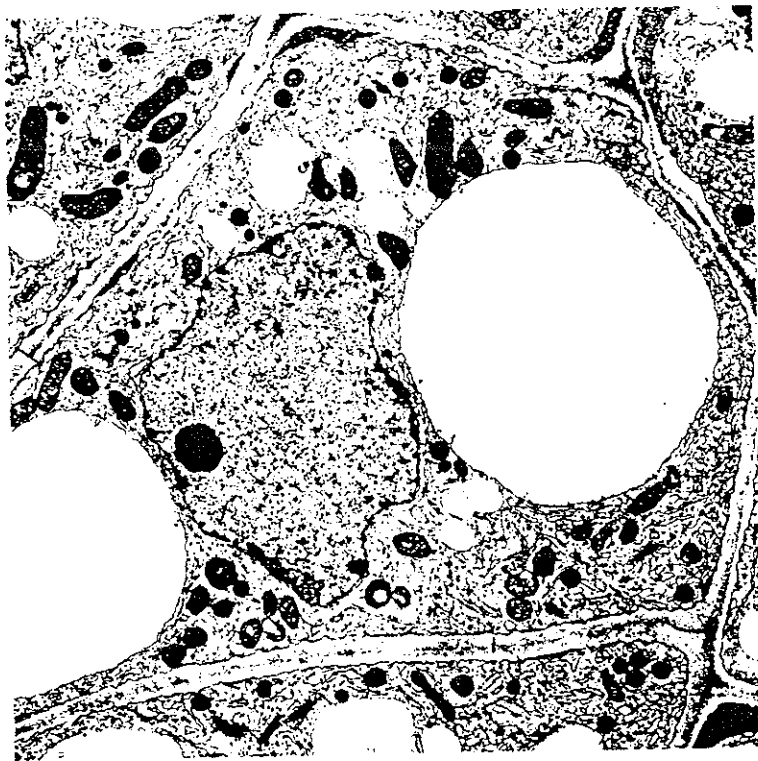


Fig. 1

Figure 2 is a tracing of the same cell as seen under lower magnification while Figure 3 shows a further reduction in magnification.

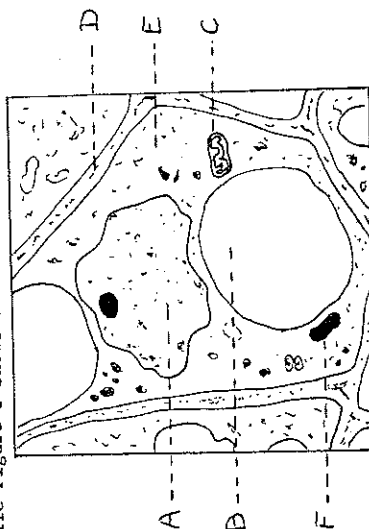
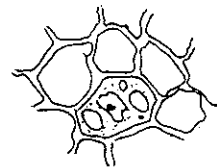


Fig. 2

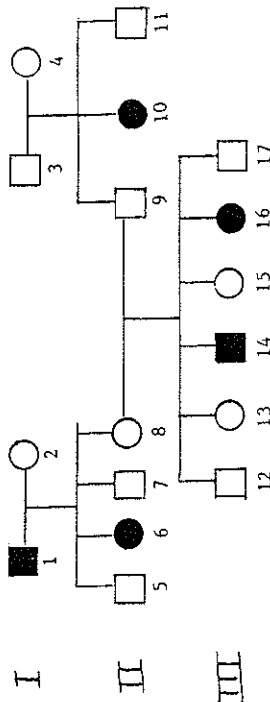
Fig. 3



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SECTION C

45. (5 marks)
An inherited condition known as cataract (corneal opacity) is found in canaries. The pedigree below shows the occurrence of this condition in three generations (labelled I, II and III) of canaries. The circles indicate females, the squares are males and the presence of cataract is shown by shading.



(a) Is cataract recessive or dominant?

(b) Determine the genotypes of 2, 3, 8 and 16.

2 _____ 3 _____

8 _____ 16 _____

(c) If individuals 5 and 6 were mated, what would be the genotypes and proportions of the offspring?

Genotype

Proportion

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

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Suggested time: 45 minutes (24 marks)
There are three alternatives to each question. Choose ONE alternative from 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) Plants may reproduce sexually or asexually.

Figure X

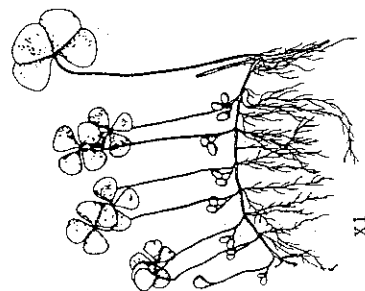
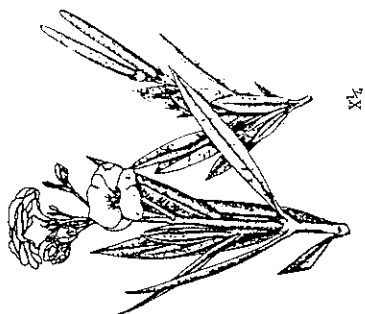


Figure Y



(i) Which type of reproduction is exemplified in firstly Figure X, and secondly Figure Y? Give reasons for each choice.

(ii) Describe the advantages of sexual over asexual reproduction to a species.

(iii) Which process in meiosis leads to some of the differences described in (ii)? Explain your answer.

(iv) Select an Australian animal and discuss its reproductive cycle with particular emphasis on the following aspects: reproductive rhythm; means of bringing the sexes together; courtship; survival of offspring.

OR

(b) Materials are exchanged between the external and internal environments of the body and between one functioning tissue and another. Discuss this statement with respect to nutrients, oxygen and water, showing (i) where and how they are absorbed into the body, and (ii) how they are transported through the body to the cells requiring them.

OR (c) [is on page 26] SEE PAGE 26

46 (continued)

- (c) Two species of spider mite, the two-spotted mite and the red mite, are leaf-sucking pests in Australian orchards, feeding on deciduous fruit trees. Both species have short life cycles (10-14 days in warm weather) and can completely defoliate a tree by midsummer.

The two-spotted mite and the red mite have different climatic preferences (see Fig. 1) but both have flourished to become pests since orchards were first sprayed with insecticides and fungicides. These two types of sprays kill all of the organisms shown in Fig. 2 except the spider mites.

Miticides will kill mites but must be sprayed three times a year at a cost of \$50 per hectare for each spraying, and after only four or five years the spider mites develop a resistance to each new miticide.

Investigations published by CSIRO scientists in the journal *ECOS* revealed the existence of two predatory mites which are largely unaffected by insecticides and fungicides. *Typhlodromus occidentalis* from the U.S.A. has a distinct preference for all stages of the two-spotted mite as food and spreads rapidly through an orchard, but it is killed by DDT. *Typhlodromus pyri* from New Zealand feeds on the red mite although it cannot destroy the tough eggs of the latter and unfortunately is very slow to disperse.

With this information and the three figures in mind, how would you advise Australian orchardists on the most effective way to control both of the spider mites?

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The main orchard districts

Two-spotted mite affects all orchards; European red mite is a pest only in Tasmania and the highlands of New South Wales and Queensland.

Fig. 1

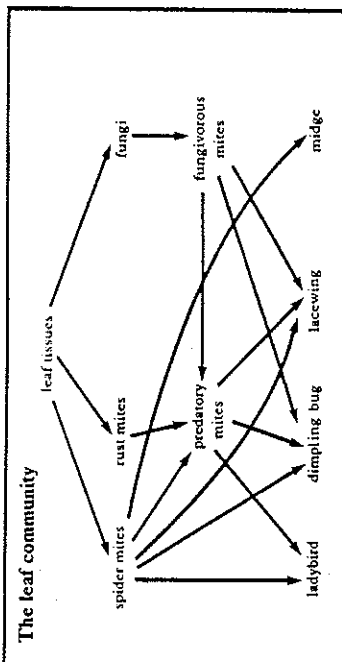
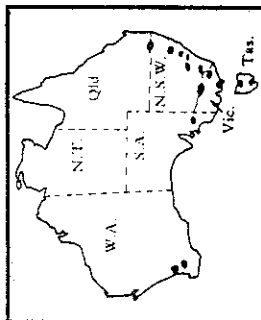


Fig. 2

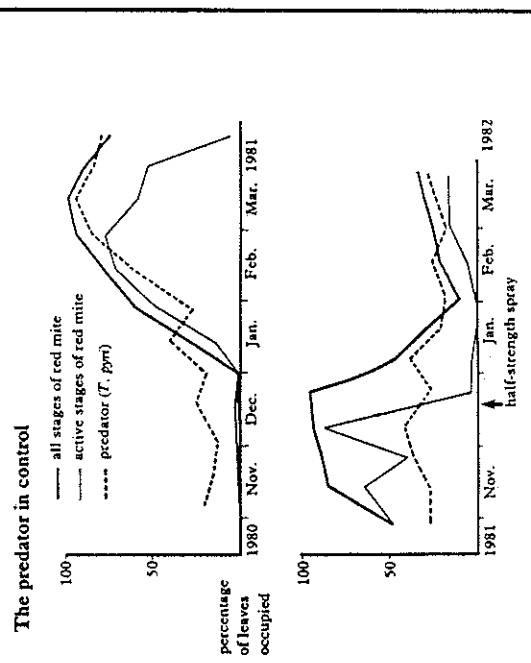


Fig. 3

In this orchard, European red mites were well controlled by *Typhlodromus pyri* in 1980-81, and only one application of half-strength spray was needed the following year.

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47. EITHER (a)

Fig. 1. Map of the Swan River.

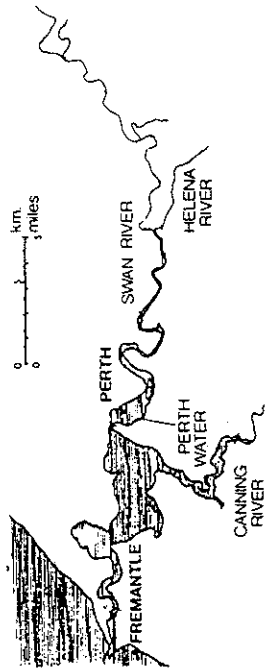


Fig. 2. Generalised food web of organisms in Perth Water.

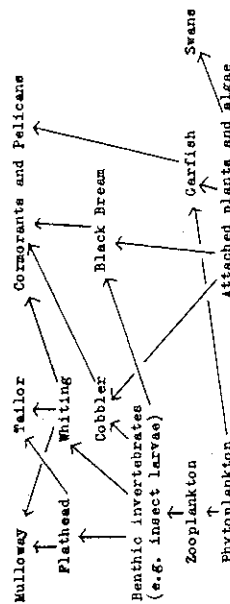
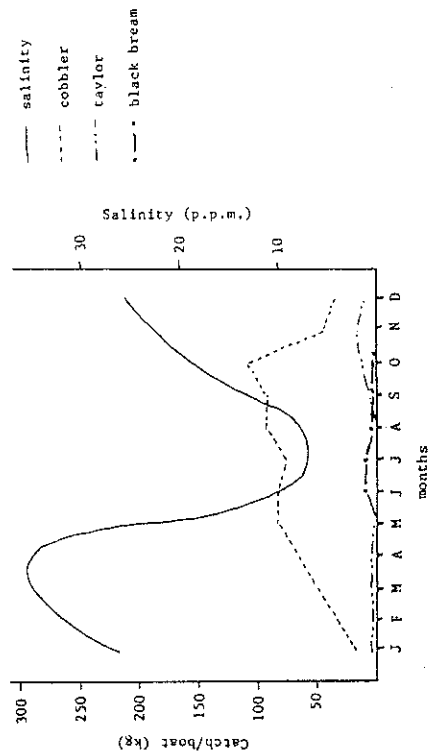


Fig. 3. The average monthly catch/boat for Perth Water over the period 1967-1969. Water salinity is shown in parts per million (p.p.m.).



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47 (a) continued.

Net fishermen in Perth Water have noted that the composition of their catch varies at different times of the year. Research has revealed the information given on the previous page.

- (i) Suggest why black bream are found in Perth Water in winter but not at other times.
- (ii) In view of your answer to (i), what changes in species density and distribution might you expect in Perth Water between summer and winter? Give reasons for your statements.
- (iii) Large numbers of crabs, fish and jellyfish are found decaying on the river banks in winter. Explain this.
- (iv) Discuss the reasons for the variations in catches for the years 1952-1974 which are shown in the following table.

Table of annual production data (kg) for most important commercial fish and crustacean species taken from the Swan-Canning Estuary over the period 1952-1974

Year	Perth herring	Mulloway		Cobbler	Tailor	Flathead	Mulloway	Prawns	Crabs	Men	Boats
		Sea	Yellow-eye								
1952	419	20761	1559	1485	4218	618	38	143	9675	16	13
1953	166	19777	2721	1957	2128	990	27	86	16781	18	15
1954		19519	2588	1284	1901	410	43	12	6973	13	12
1955	1871	15386	4631	3861	1710	1726	8	3	7588	14	13
1956	4278	20654	1965	1056	2624	3012	72	5076	8233	15	14
1957	19239	36500	4238	3183	2600	1350	67	8854	3899	17	15
1958	9182	86276	4987	5661	3496	956	5	3856	11414	20	19
1959	8422	73883	5857	21523	3195	624	417	16369	10196	24	22
1960	15946	42941	20801	56586	4552	3869	639	7909	51203	30	27
1961	16153	116084	15157	44780	7977	2063	188	1014	10436	34	30
1962	11256	42390	10051	49371	2584	2097	557	1134	8714	23	20
1963	60361	64784	16288	38259	2464	4707	3667	607	1734	29	25
1964	65266	17899	23877	2769	2150	638	2599	682	1745	22	19
1965	43434	62761	3624	26098	1857	1157	8452	2304	1204	25	22
1966	52340	74051	6106	13475	1551	2133	2113	2295	1204	25	22
1967	89701	57241	8909	18345	1352	3652	1908	785	8799	29	24
1968	177611	36558	5587	15142	1871	3140	5369	270	15424	31	25
1969	62048	52387	17155	29127	2626	2015	3587	748	7052	34	27
1970	46518	69267	29354	49554	2904	3076	3477	1289	3324	30	25
1971	71454	44941	29406	39738	2330	1996	3684	955	12737	33	27
1972	147432	48044	11241	23596	1684	1017	1461	545	16179	33	27
1973	158606	76162	21045	33480	1899	904	2630	150	12888	33	27
1974	97363	71627	15799	40210	823	1955	2240	78	22700	33	28

Questions 47(b) and 47(c) are on page 30.

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47. (continued)

OR (b) Man's actions can have wide-ranging effects on the environment of an area: some beneficial, some harmful. As Seattle, an American Indian chief, said in 1854:

"This we know, the earth does not belong to man; man belongs to the earth. This we know. All things are connected like the blood which unites one family. All things are connected.

Whatever befalls the earth befalls the sons of the earth. Man did not weave the web of life: he is merely a strand in it. Whatever he does to the web, he does to himself."

Compare and contrast the likely effects of two of man's actions, one of which may have beneficial effects and one which may have harmful effects on the environment. Some possible environmental examples to direct your thinking are: Point Peron sewage outlet, the Whitford Nodes, the Fitzgerald National Park, the Shark Bay proposals, allowing cleared land to go back to nature, clearing bans on salt-affected river areas in the south-west of W.A., development proposals for Rottnest Island. You may decide to use any of these situations or others of your own choice in developing your answer.

Include in your answer the effects on the living and the non-living environment, the energy relationships and recycling.

OR (c)



Most mammals, including domestic stock, are killed by a chemical compound, sodium fluoroacetate, in doses of less than 1 mg per kilogram body weight. Some "poison plants", such as *Gastrolobium* species, produce sodium fluoroacetate which acts as a defence against herbivores. There are 33 species of *Gastrolobium* in south-western Australia but they occur nowhere else.

The small wallaby, *Bettongia penicillata*, has been in south-western Australia for at least 30,000 years. A similar species, *Bettongia lesueur*, was widespread through the south-west but is now found only on islands off the coast where it has been isolated for about 7,000 years. A third species, *B. gaimardi*, occurs in Tasmania.

B. gaimardi is killed by small amounts of sodium fluoroacetate. *B. lesueur* is slightly affected by the poison and *B. penicillata* remains unaffected by doses over 100 mg per kilogram body weight.

(i) Explain how the differences in tolerance to this poison may have arisen.

and (ii) Sodium fluoroacetate has been suggested as a means of controlling rabbits. What advantages and disadvantages would it have as a controlling agent?

END OF PAPER