The University of Western Australia

Leaving Examination, 1974

Leaving Level

BIOLOGY

Candidate's Number
.....

DATE AND COMMENCEMENT TIME:

Monday 18th November - 9.20 a.m.

TIMES ALLOWED FOR THIS PAPER:

Reading time before commencing: Ten minutes
For working of paper : Three hours

MATERIAL TO BE PROVIDED FOR THIS PAPER:

Question paper comprising 37 pages and 47 questions.
One piece of blank paper for rough work.

INSTRUCTIONS TO CANDIDATES:

See page 2 of this question paper.

	FOR EXAMINER'S USE ONLY				
Question Number	First Mark	Second Mark	Question Number	First Mark	Second Mark
1-40			45		
41			46		
42			47		
43					
44			Total		

INSTRUCTIONS TO CANDIDATES:

Marks will be allocated as follows: SECTION A - 40 marks

SECTION B - 36 marks

SECTION C - 24 marks

Write your number on the front of this question paper.

When you start work, detach page 37 which is the answer sheet for Section A and write your number in the box at the top of the page. Attempt all the questions in this section. Marks are NOT deducted for wrong answers.

When you have completed the Section A answer sheet, insert it inside the cover of this question paper.

Answer Sections B and C in the places provided in the question paper.

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

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

See page 3.

SECTION A.

Suggested time: 60 minutes (40 marks)

Record each answer for questions 1 - 40 by marking your choice of alternatives on the answer sheet (page 37). For example, if your choice is 3, show it as follows:-

1	2	3	4	5

An error in recording your choice may be cancelled by completely blocking out the error.

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

---

1. When rabbits were introduced into Australia they bred rapidly and, by the end of last century, were in plague proportions. The best reason for the success of rabbits in this country is that:-

   1. the rabbits were able to adapt themselves to the new climate.
   2. there were no predators in this country.
   3. the burrows in this country are seldom flooded.
   4. there was little competition between rabbits and other species.
   5. Australian rabbits are a hardier strain of the species.

2. Most of the mass of carbon which is formed into living matter by photosynthetic plants -

   1. is stored for food.
   2. remains as dead organic matter.
   3. is released by plant respiration.
   4. is released by animal respiration.
   5. is released by decomposers.

3. All consumers must live in an environment where they can obtain -

   1. minerals.
   2. available carbon dioxide.
   3. nitrogen compounds.
   4. shelter.
   5. organic compounds.

See page 4.

Questions 4 to 9 are based on the following food web of a salt marsh in California.

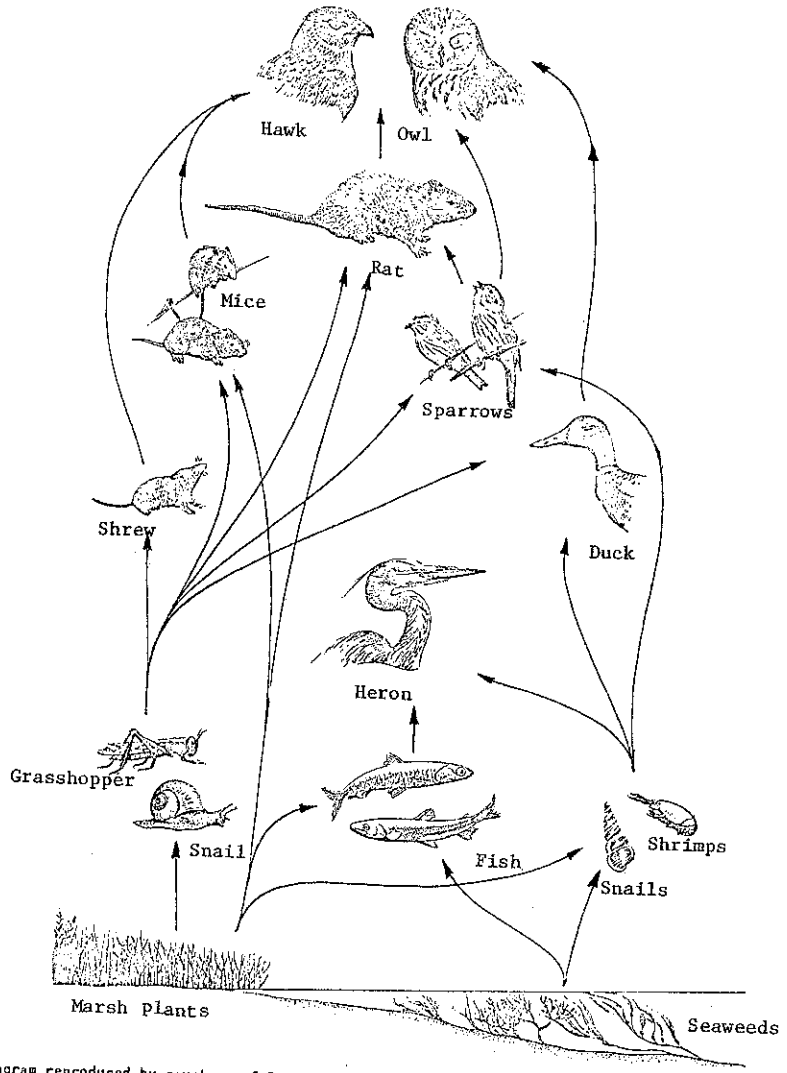


Diagram reproduced by courtesy of Dr. Claude A. Villee from his book "Biological Principles and Processes" published by W.B. Saunders, 1971.

SEE PAGE 5

4. Energy for the birds in this food web is originally derived from:-

1. green plants.
2. mice and rats.
3. light rays from the sun.
4. water.
5. invertebrates.

5. The fact that there are greater numbers of snails than rats in the marsh is chiefly because:-

1. rats are much larger than snails.
2. rats are warm blooded and metabolise at a faster rate than snails.
3. snails live on plant food whereas rats must hunt for animal food.
4. snails reproduce more quickly than rats.
5. only a little of the food energy eaten by the snails is available to the rats since the snails use up a large proportion themselves.

6. In this community the Shrew is -

1. a decomposer.
2. a first-level carnivore.
3. a herbivore.
4. a second-level carnivore.
5. an omnivore.

7. One group of organisms which live in the community is not indicated in the diagram. These are the -

1. algae.
2. fish.
3. second-order carnivores.
4. decomposers.
5. producers.

8. The diagram above is fairly simple. In fact biologists -

1. can only be sure of the relationships shown here.
2. understand more of the relationships than are shown here, but not all.
3. are only guessing at some of the relationships shown here.
4. now understand all the relationships between the organisms in the area.
5. will probably understand all the relationships between the organisms within the next ten years.

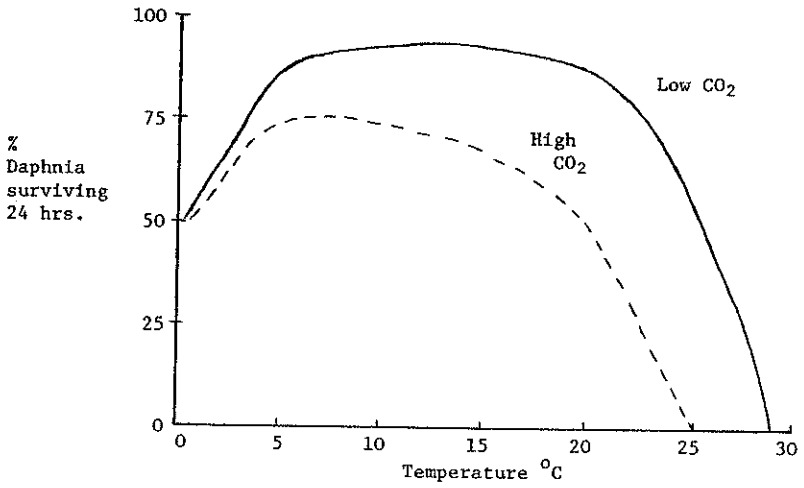
See page 6.

9. Producer organisms are always -

1. able to synthesize amino acids.
2. green in colour.
3. multicellular.
4. terrestrial.
5. grown in sunlight.

Questions 10 to 11 are based on the following data and graph.

Equal samples of Daphnia were exposed to several different temperatures and their survival was measured by counting the percentage in each sample which survived for 24 hours at each temperature. The experiment was repeated in water into which carbon dioxide had been bubbled. The data were graphed as shown.



10. The graph indicated that -

1. the temperature tolerated best in both experiments was 12°C.
2. temperatures between 5° and 20° are optimal for Daphnia.
3. Daphnia live longer in high CO_2 conditions.
4. Daphnia live longer in low temperatures.
5. Daphnia tolerate CO_2 better at low temperatures.

See page 7.

11. The data indicated that Daphnia would not be found in ponds where -

1. the temperature falls below 10°C.
2. the temperature rises above 15°C.
3. there is little CO_2 in the water.
4. there is a lot of CO_2 in the water.
5. there is a lot of CO_2 in the water and the temperature rises above 15°C.

12. Antarctic penguins are much larger than penguins which live in warmer climates. Which of the following would most likely help to explain this observation?

1. The breeding season in Antarctica is shorter, so penguins lay fewer, larger eggs.
2. The fishes which penguins eat are larger in cold water than in warm water.
3. Cold air has a larger percentage of oxygen than warm air.
4. Large bodies have a smaller surface-to-volume ratio than small bodies.
5. Fewer parasites live in Antarctica than in warmer climates.

13. In some West African frogs the males have many fine finger-like projections from the skin which give them a hairy appearance even though the skin is thin and wet. The purpose of these structures is to -

1. keep them warm since they live in cold water.
2. increase the excretion of waste products from the body.
3. assist in respiration, since they spend a lot of time underwater.
4. enable them to carry the eggs about on their bodies.
5. act as a protection from the sun's rays.

14. The frog, crocodile and hippopotamus all breathe air and live in the water. They all have eyes and nostrils in a position which enables them to breathe and see over the surface while their bodies remain submerged. These features provide evidence for -

1. the selective effect of the environment during the evolution of these animals.
2. formation of special structures during the animals' growth in response to environmental demands.
3. evolution of these animals from a common ancestry.
4. the essential characteristics of water-dwelling, air-breathing animals.
5. the need for water-dwelling animals to see over the surface.

See page 8.

15. The misletoe plant produces a sticky fruit. This feature may be regarded as an adaptation to -

1. protect the seed from being eaten by birds.
2. protect the seed from being digested in the bird's stomach.
3. increase the seed's chances of being carried to a new host.
4. increase the seed's chances of sticking to a new host.
5. both (3) and (4) above.

16. A parasite could be considered of value to man if the host organism is -

1. unaffected by the parasite.
2. harmful to man.
3. of benefit to man.
4. easily found by the parasite.
5. a source of human food.

Questions 17 to 20 are based on the following observations of the ecosystem of a pond -

All larger weeds in a pond were removed.
The single celled algae increased.
The carnivorous fish population was greatly reduced.
The bottom living fish population was relatively unchanged.

Consider the following statements. Choose which of the key sentences below best describes each statement.

KEY A. The statement is correct and it can be so determined from the data.
B. The statement is incorrect and it can be so determined from the data.
C. The statement is correct, but the data do not prove it.
D. The statement is incorrect, but the data do not prove it.

17. The larger weeds must have been part of the food web.

18. Algae alone are responsible for the community balance.

19. Conditions in the pond became more suitable for bottom living animals.

20. There was more available food for the fish.

See page 9.

21. The bacteria normally inhabiting the large intestine of man -

1. constitute a serious health problem.
2. are accidentally introduced in the food we eat.
3. are constantly poisoning the system.
4. are more important in man than in the herbivorous animals.
5. are usually helpful as long as they do not invade other parts of the body.

22. A single female codfish lays several million eggs in a single season, yet the waters of the earth are not filled with codfish. Which of the following is the most likely explanation of this observation?

1. Codfish have a very short life cycle.
2. Many codfish starve to death early in life.
3. Most of the eggs a female codfish lays are not fertilized.
4. Most young codfish are eaten by predators before they reach adulthood.
5. Codfish only lay eggs in a few seasons during their life.

23. The rate of growth of the world population of human beings is more rapid now than it was 100 years ago. This is primarily because of -

1. an increased birth rate.
2. a decreased death rate
3. more adequate food supplies
4. increased immigration
5. less warfare.

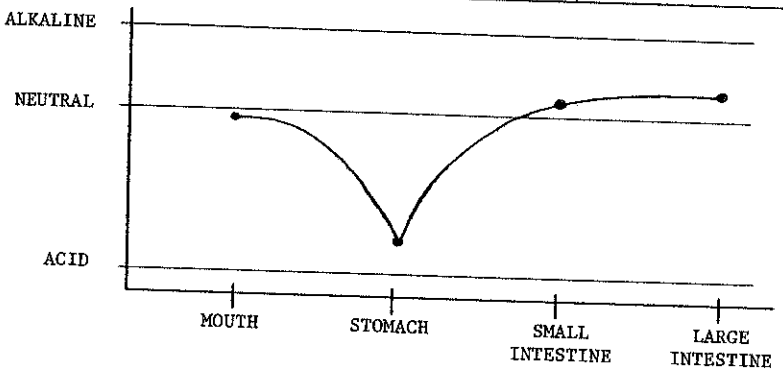
24. Small animals like mice require more food and oxygen, per gram of body weight, than do large animals because -

1. they move more rapidly.
2. they must hunt for their food.
3. they are exposed more often to attack by predators.
4. their bodies are maintained at a higher internal temperature.
5. they use up more energy in maintaining a constant internal environment.

See page 10.

Questions 25 to 28 are based on the following data and graph.

ENZYME	SUBSTANCE ATTACKED	OPTIMUM ACIDITY
Salivary amylase	starch	neutral
gastric protease	protein	acid
pancreatic protease	protein	slightly alkaline
lipase	fats	slightly alkaline
maltase	maltose	neutral



25. On the basis of the above information amylase would be most active in the:

1. mouth
2. stomach
3. small intestine
4. large intestine

26. Some of the enzyme lipase was mixed with a fat at a temperature of 37°C and in acid medium but no reaction took place. This is probably because:

1. the temperature was too low.
2. the temperature was too high.
3. the medium was too alkaline.
4. the medium was too acid.
5. this enzyme does not react with fats.

See page 11.

27. From the above information, if gastric protease were to enter the small intestine it would likely -

1. continue to act in the same way.
2. stop acting because the pancreatic protease replaces it.
3. stop acting as the solution becomes less acid.
4. continue to act but attack different substances.
5. it is not possible for this enzyme to get into the intestine.

28. If some maltase was mixed with starch at a temperature of 37°C in a neutral medium it would probably -

1. not attack the starch at all.
2. attack it but much more slowly than amylase.
3. attack it more quickly than at 30°C.
4. attack it the same as amylase does.
5. attack it as the acidity gradually increases.

29. The energy used by a cell may be obtained by the breakdown of energy rich compounds. A cell structure which is involved in this process is -

1. chloroplast.
2. cell membrane.
3. vacuole.
4. mitochondrion.
5. ribosome.

30. Which substance listed below is needed by a gum tree but not by all its living cells?

1. water.
2. oxygen.
3. carbon dioxide.
4. a nitrogen-containing compound.
5. a phosphorus-containing compound.

31. The substances transported by a plant stem are chiefly -

1. water in the xylem and sucrose in the phloem.
2. sucrose in the xylem and water in the phloem.
3. glucose in the phloem and water in the xylem.
4. minerals in the xylem and glucose in the phloem.
5. sucrose in the xylem and starch in the phloem.

See page 12.

32. A green plant, exposed to the light on one side only, bends towards the light as it grows. Which of the following sentences best explains this observation?

1. Green plants need light for photosynthesis.
2. Green plants seek the light because they are phototropic.
3. Light stimulates the cells on the lighted side to grow faster.
4. Auxin is more concentrated on the shaded side so that the cells on that side grow longer.
5. Light stimulates nerves on the lighted side more than on the shaded side.

33. When a thin transverse section of a plant stem was stained with weak iodine solution, violet-coloured spots appeared in the cells in the centre of the stem. The most likely explanation of this is that -

1. These cells can make starch by photosynthesis.
2. These cells can make starch from sugar transported to them from other parts of the plant.
3. Starch diffuses into these cells from other parts of the plant.
4. Protein diffuses into these cells from other parts of the plant.
5. All of the above.

34. If the girth of a tree is accurately measured at some fixed height on the trunk a rhythmic fluctuation in girth is found over a daily cycle, the girth increasing at night and decreasing during the day.

The decrease in girth during the day is produced by -

1. The shrinkage in timber due to the rise in temperature.
2. The lowering of the atmospheric pressure due to the expansion of air with rise in temperature.
3. The lowering of the root pressure during the hot part of the day.
4. The increase in water tension due to the increased transpiration.

35. The use of radioactive Carbon to estimate the age of fossil remains does NOT depend on the principle that -

1. Living things use Carbon 14 in the same way as they use Carbon 12.
2. Carbon 14 is continually produced in the upper atmosphere.
3. A dead organism stops absorbing Carbon 14.
4. The breakdown of Carbon 14 is a very slow process.
5. Organisms give out Carbon 14 during the process of respiration.

See page 13.

Questions 36 to 38 are based on the following data.

A number of similar cells were cut in half and the pieces kept in conditions which ensured their survival as long as possible. Results were obtained as follows -

	CELL FRAGMENTS	% SURVIVAL AFTER CUTTING IN HALF						
		INITIAL NUMBER 0	DAY 1	DAY 2	DAY 3	DAY 4	DAY 10	DAY 30
A	HALF WITHOUT NUCLEUS	100	81	62	20	0	-	-
B	HALF WITH NUCLEUS	100	79	78	77	74	67	65

36. 81% of the halves without nuclei and 79% of the halves with nuclei survived one day. A possible explanation for this result is -

1. The results are due to chance factors.
2. The nucleated halves were more damaged by the treatment.
3. The halves without nuclei were larger.
4. Cells with nuclei use up food more quickly.
5. The nuclei are not necessary for survival for less than two days.

37. The hypothesis which was most probably being tested by this experiment was -

1. The nucleus of a cell is necessary for its life.
2. The nucleus of a cell maintains the continuing function of a cell which keeps it alive.
3. Cells can live for several days without nuclei.
4. When cut in half, cells will die.
5. Cutting a cell in half makes little difference to its functioning.

38. In both groups of cells approximately 20% died in the first day and by the end of 30 days even among the nucleated halves 35% had died. This death rate is probably -

1. The normal death rate of this type of cell.
2. Greater than the normal death rate of these cells but not unusually so.
3. Due at first to injury by the treatment and later to natural causes.
4. Unusually high, especially towards the end of the experiment.
5. Entirely due to the treatment in the experiment.

See page 14.

39. Between 1920 and 1956, biologists agreed that human nuclei contained 48 Chromosomes. Since 1956 they have agreed that they contain 46 chromosomes. Which of the following is NOT a reasonable explanation for this discrepancy.

1. The human chromosome number is less than it was in 1920.
2. Recent developments in microscopy have improved the accuracy of our knowledge of cell structure.
3. Careful counts of chromosomes were not made between 1920 and 1956.
4. An error was made in the original chromosome counts.
5. Counting human chromosomes is a complex task which had not often been attempted before 1956.

40. The offspring of sexually reproducing organisms show greater diversity than those of organisms that reproduce asexually. The chief reason for this is that -

1. Sexual reproduction ensures a higher mutation rate.
2. Sexually reproducing organisms have greater powers of dispersal, so their offspring encounter more varied environments.
3. Chromosomes are reshuffled during meiosis and fertilization.
4. Natural selection only acts on sexually reproducing organisms.
5. Sexually reproducing organisms form the dominant species of the world.

See page 15.

SECTION B

Suggested time: 75 minutes (36 marks)

Attempt ALL the questions in this section.

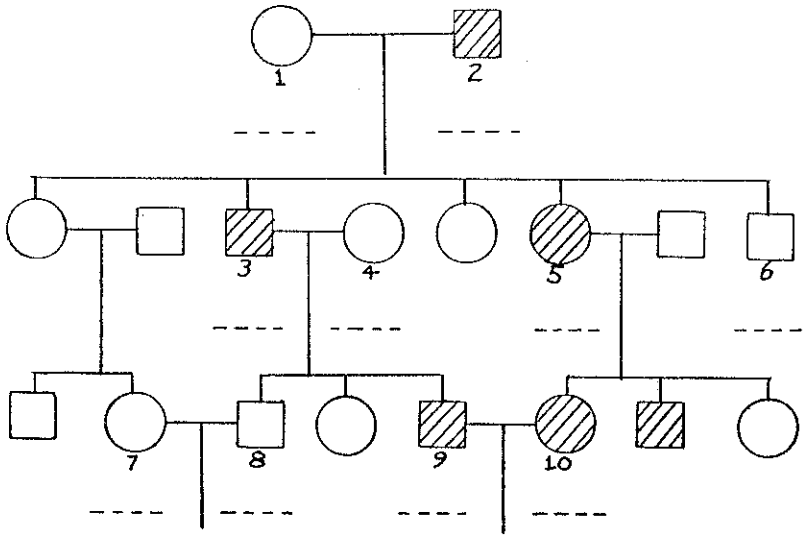
Write your answers in the spaces provided.

41. (9 marks)

A colony of white mice was kept in a laboratory for many generations and had always produced white offspring. However, a brown coated mouse was discovered among the offspring of one mating. On mating this mouse to one of its white relations a mixed litter of brown and white offspring was produced. The following pedigree diagram shows some of the members of this family.

Circles represent females, squares represent males and black shading indicates brown coat colour.

(a) Using B and b to represent the dominant and recessive alleles respectively, write the genotype of the numbered individuals on the dotted lines provided in the diagram.



See page 16.

41. (continued)

(b) Some possible matings might occur amongst the third generation of mice. What proportions of brown and white mice would you expect amongst the offspring of:-

7 x 8 _____

9 x 10 _____

(c) What explanation can you suggest for the appearance of the brown coat colour allele in this population of white mice?

_____

_____

_____

_____

42. (5 marks)

A biologist collected 768 specimens of an estuarine snail from 4 different square metre areas on a mud bank in the Swan River -

(a) Estimate the density of the snail population on this bank.

_____

(b) He chose the 4 different areas by throwing a wire frame onto the mud bank from a distance. Why was this method used?

_____

_____

(c) If he wished to know the total population of snails in the area, what additional information would he require?

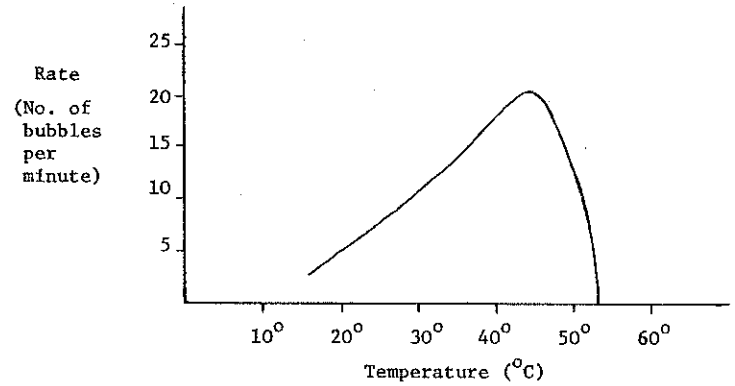
_____

_____

See page 17.

43. (8 marks)

The rate at which photosynthesis takes place is often estimated by the rate at which bubbles of gas are given off from the cut end of an aquatic plant. The graph below shows the rate at which photosynthesis took place when an aquatic plant was illuminated in water at different temperatures.



(a) How much faster (approximately) was photosynthesis at 30°C than at 20°C?

_____

(b) At what temperature was the maximum rate of photosynthesis achieved?

_____

(c) Give an explanation for the rapid drop in photosynthetic activity after the maximum was reached.

_____

_____

_____

_____

(d) The light intensity was kept constant during this experiment. What other important requirement for photosynthesis would have to be kept constant for the result to be valid?

_____

See page 18.

43. (continued)

(e) (i) If the factor stated in answer to (d) is not kept constant how would the rate of photosynthesis compare with the rate in an experiment in which it is kept constant?

_____

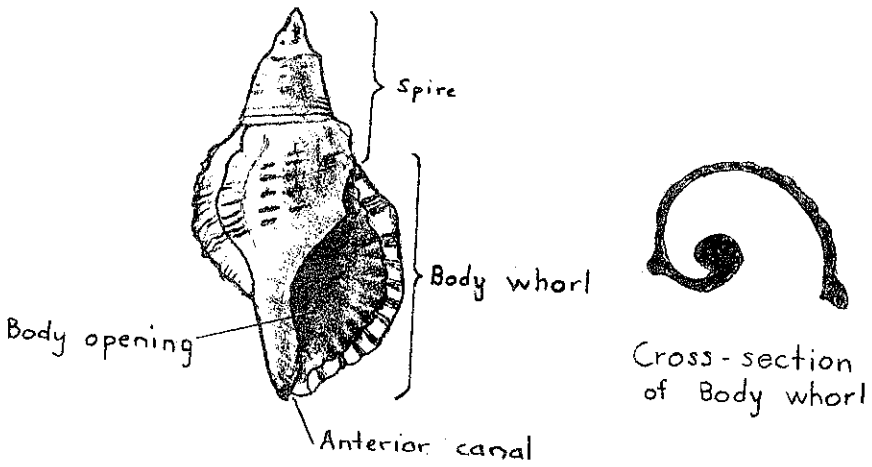
(ii) Give a reason for your answer.

_____

_____

44. (4 marks)

Determine the family to which this gastropod shell belongs using the key provided. Mark the positive steps in the key which lead you to your identification by placing X in the appropriate box at each step.



( ) 1a. Conical or flattened shells with opening across whole of lower surface.....2

( ) 1b. Opening not across whole of lower surface.....5

See page 19.

44. (continued)

( ) 2a. Shell with row of holes on left side.....Fam. Haliotidae

( ) 2b. Without a row of holes.....3

( ) 3a. With hole in top.....Fam.Fissurellidae

( ) 3b. Without hole in top.....4

( ) 4a. Horn shaped shell.....Fam.Hipponicidae

( ) 4b. Conical shell.....Fam.Patellidae

( ) 5a. Shell with obvious spire.....8

( ) 5b. Spire hidden or enclosed in body whorl.....6

( ) 6a. Opening long and narrow with teeth.....Fam.Cypraeidae

( ) 6b. Opening without teeth or wrinkles.....7

( ) 7a. Spire flattened.....Fam.Hydatinidae

( ) 7b. Spire deeply sunken.....Fam.Bullariidae

( ) 8a. Opening narrow, nearly full length of shell...Fam.Cassididae

( ) 8b. Opening oval or circular.....9

( ) 9a. Shell irregularly coiled or tubular.....Fam.Vermetidae

( ) 9b. Shell coiled normally.....10

( ) 10a. Body whorl more than three fourths of total length.....
.....Fam.Tonnidae

( ) 10b. Body whorl less than two thirds of total length.....11

( ) 11a. Shell broadly conical, wider than its height.....
.....Fam.Littorinidae

( ) 11b. Shell not wider than its height.....12

( ) 12a. Shell with thickened lip of opening.....13

( ) 12b. Lip of opening thin edged.....14

( ) 13a. Spire more than twice height of body whorl...Fam.Potamididae

( ) 13b. Spire less than twice height of body whorl....Fam.Cymatiidae

( ) 14a. Shell with anterior canal.....Fam.Nassidae

( ) 14b. Without anterior canal.....Fam.Phasianellidae

See page 20.

45. (10 marks)

Several hundred seeds of two different types were subjected to heat treatment by being heated to 80°C for times as shown on the table. On planting these seeds out some germinated and some did not. The percentage of seeds of each type which germinated is shown in the table.

Seeds	Percentage germinating after 80°C for:				
	0 min	5 min	10 min	15 min	20 min
Type A	0	7	22	84	55
Type B	89	4	2	0	0

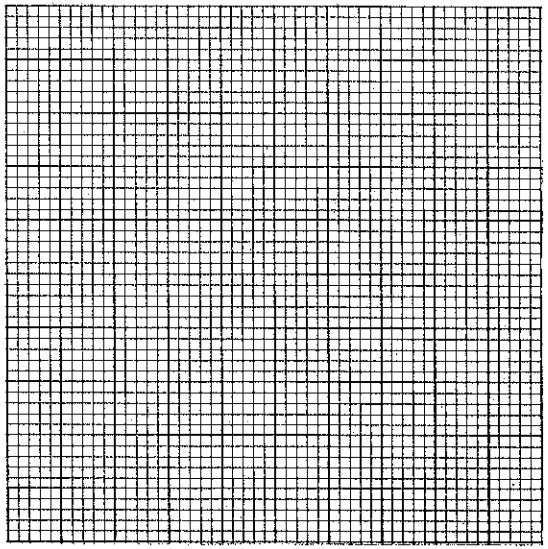
(a) Why were so many seeds used in the experiment?

(b) After studying the table one biologist wrote "Obviously type B seeds do not require (or like) heat treatment for germination. It therefore seems unreasonable that even 2% should germinate after 10 minutes of heat treatment".

Do you agree or disagree with this statement? Why?

(c) Graph the results on the graph paper provided.

See page 21.



(d) Which treatment produced the best percentage germination of type A seeds?

(e) Is it possible that a different treatment <u>time</u> would produce better percentage germination of these seeds?

Is it possible that a different <u>temperature</u> would produce better germination results with Type A seeds?

Explain your answers to these questions.

See page 22.

45. (f) What natural conditions might produce maximum germination of Type A seeds?

See Page 23.

SECTION C.

Suggested time: 45 minutes. Each question is worth 12 marks.

Answer BOTH questions.

Write your answers on the sheets provided at the end of this section.

46. EITHER (a)

(a) In much of Central Australia the rainfall is infrequent and the rate of evaporation is high. Temperatures in the shade in the daytime are often very high, and may fall close to freezing at night. Vegetation in the area includes spinifex grasses, small herbaceous plants such as everlastings, thin-leaved mulgas and fleshy leaved salt bushes. Animals include spiders, millipedes and many small insects, desert frogs and small and large marsupials.

This region poses some distinctive environmental problems to the organisms which live in it. Choose two organisms, an animal and a plant, which live in the region and describe

(i) two environmental problems they must cope with in order to survive and,

(ii) one way in which each is adapted to cope with each problem.

OR (b)

(b) Consider the statement "Living systems require energy". A cell in an animal's body is a living system. Explain how such a cell obtains the energy which it needs to keep it living.

47. EITHER (a)

(a) Hens kept for egg-laying purposes are often fed completely on commercially produced food mixes. A group of laying hens were fed the same quantity of a new diet over an extended period. During this period their egg production was significantly lower than before. Give some possible reasons for this reduced egg production. Describe briefly an experiment which could be performed to test a hypothesis you have suggested. What results would you expect to support your hypothesis?

See page 24.

OR (b)

(b) Below is an account of the butterfly Euphydryas aurinia written by a biologist named Ford in 1945.

> The species was quite common in 1881, and gradually increased until by 1884 it had become exceedingly abundant. After 1897, the numbers began to decline, and from 1906 to 1912 it was quite scarce. From 1913 to 1919 it was very rare, so that a few specimens only could be caught each year, where once they were to be seen in thousands. From 1920 to 1926, a very rapid increase took place, so that by 1925 the butterfly had become excessively common and so it remained until we ceased our observations in 1935.
>
> The amount of variation in colour, pattern of markings and shape was small during the first period of abundance and while the species was becoming scarce. When the numbers rapidly increased, a large number of variations appeared in the population such that hardly any two specimens were alike in colour, pattern of markings and shape. A high proportion of individuals was deformed in various ways and some could hardly fly. When the rapid increase had ceased, such abnormalities became rare and the population settled down once more to a fairly uniform type.

Suggest some possible explanations for the fluctuations in numbers of the butterflies during the period of observation and an explanation for the variations in the form of the butterfly during the same period. In your answer you should refer to such things as competition, natural selection, mutations etc.

END OF PAPER