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.

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.

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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	X	4	5

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

Give only ONE answer to each of questions 1 - 40.

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1. Most plants are producer organisms because
   1. during photosynthesis carbon dioxide is used and oxygen is given off
   2. plants serve as food for other organisms
   3. plants convert sunlight into chemical energy
   4. carbon dioxide is only given off at night.

2. Which of the following organisms is NOT a producer?
   1. Fungus
   2. Chlamydomonas
   3. Mistletoe
   4. Eucalyptus (Gum tree)
   5. Lichen.

3. Which of the following describes photosynthesis?
   1. A process whereby plants utilise oxygen to drive uphill reactions
   2. A process whereby carbon dioxide and energy from respiration are used to drive uphill reactions
   3. A process whereby energy from the sun is converted and used to drive downhill reactions
   4. A process in which energy from the sun is converted and used to drive uphill reactions.

4. Which of the following compounds cannot be moved through plant tissues?
   1. Sucrose
   2. Starch
   3. Water
   4. Proteins
   5. Amino acids

See page 4

5. A piece of turgid (crisp) potato tissue was put into a concentrated (1.0 M) sucrose solution. After ten minutes the tissue was removed and was found to have become soft and pliable. This was probably because

1. the concentration of water molecules was greater outside the cell. Therefore water molecules diffused into the cells and burst them
2. the concentration of sucrose solution was greater outside the cells. Therefore sucrose molecules diffused into the cells and burst them, shrinking the tissue and making it soft and pliable
3. the concentration of water molecules was greater inside the cells. Therefore water diffused out of the cells, shrinking the tissue and making it soft and pliable
4. the concentration of sucrose was greater inside the cells. Therefore sucrose diffused out of the cells, shrinking the tissue and making it soft and pliable
5. the results do not agree with theoretical expectations.

6. A small green leafy moss plant is

1. the sporophyte and will give rise to the spores which will undergo meiosis
2. the gametophyte and will give rise to spores which will undergo meiosis
3. the sporophyte which will form gametes
4. the gametophyte which will form gametes.

7. The following is true of a fern:-

1. the sporophyte generation is haploid
2. meiosis occurs immediately after fertilization
3. the gametophyte can reproduce asexually
4. the leafy fern plant is formed after fertilization
5. the leafy plant is formed immediately after meiosis.

8. The gametophyte generation in angiosperms is very reduced and is represented by

1. the megaspore and the germinating pollen grain
2. the egg nucleus and the gametes
3. the megaspore and the gametes
4. the egg nucleus and the pollen tube nucleus
5. the egg nucleus and the germinating pollen grain.

See page 5

9. In which of the following processes does a dividing cell give an exact replica of itself to each of its two daughter cells?

1. meiosis
2. mitosis
3. both of the above
4. gamete formation

10. An organism has a 2N chromosome number of 14. How many chromosomes will there be in each gamete?

1. 14
2. 28
3. 7
4. 21

11. An organism has a 2N chromosome number of 14. How many chromatids will there be at the beginning of the first division of meiosis?

1. 14
2. 28
3. 7
4. 21

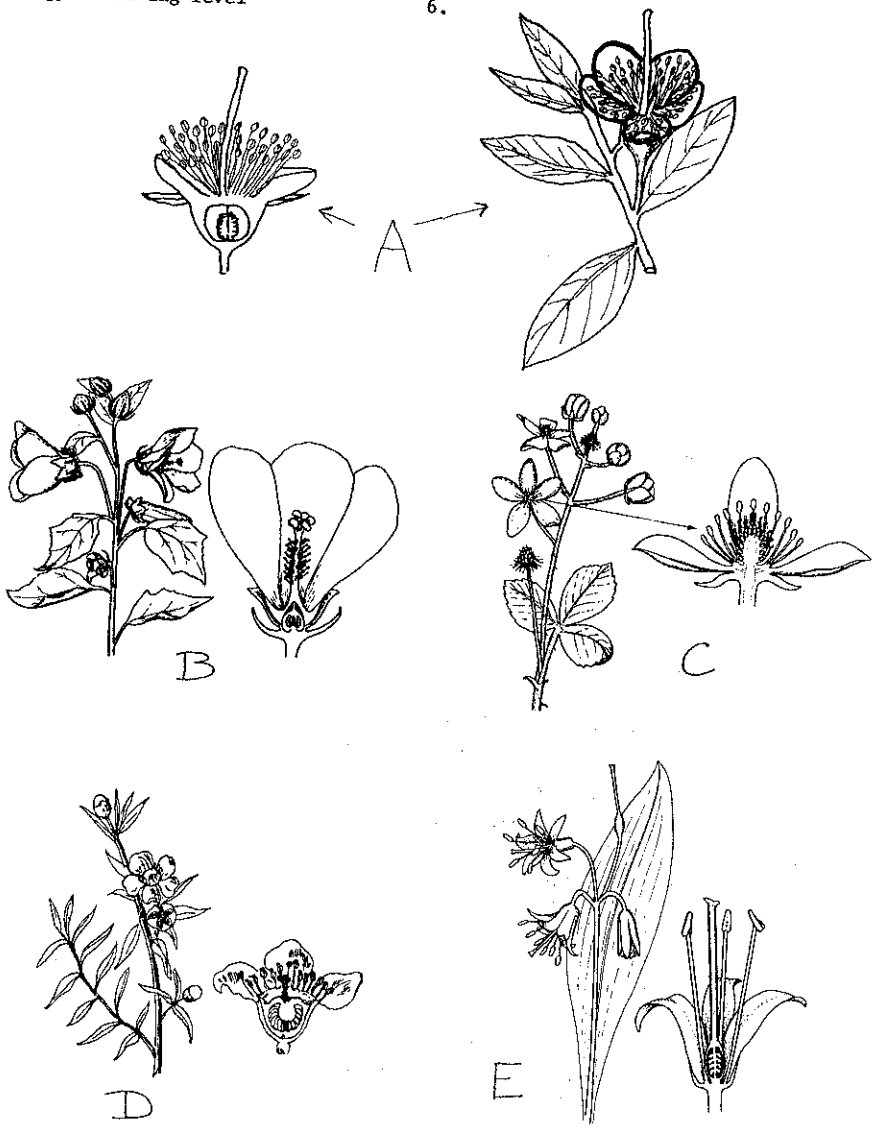
12. The destruction of all bacteria would bring life on earth to an end because

1. the organisms that feed on bacteria would starve, initiating a chain of starvation reaching to man
2. they are the hardest organisms to kill
3. evolution begins with bacteria
4. the available nutrients would soon be "locked up" in undecayed vegetation and animal bodies
5. the diseases caused by bacteria would no longer keep the numbers of organisms in check and there would be a population explosion.

13. Which of the following is the best example of a change in an animal which could result in evolution?

1. development of thicker fur in a rabbit during the winter
2. a change in the molecular structure in a gene due to radiation
3. development of strong neck muscles due to the growth of a very large set of antlers in a deer
4. all of the above.

See page 6



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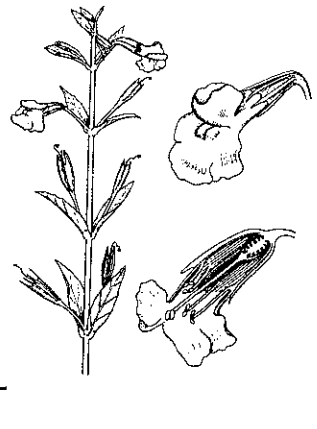


14. Which of the plants are most closely related to each other?
    1. A & B
    2. E & F
    3. A & D
    4. B & E
    5. C & F.

15. Your choice depended mainly on
    1. the number of flower parts
    2. the position of the ovary
    3. the leaf shape
    4. combination of 1 & 2
    5. combination of 1 & 3.

16. Another detail that may be needed in order to decide whether the plants are related would be
    1. the structure of the fruits
    2. the growth habit
    3. the root system
    4. the pollination mechanisms.

See page 8

17. To survive dry conditions a kangaroo must conserve water. Which of the following would NOT help to reduce the water loss from its body?

1. standing still in the shade of a rocky outcrop
2. production of small quantities of concentrated urine
3. panting
4. production of dry faeces
5. seeking food at night rather than in the day time.

18. Which of the following animals is likely to have the highest body temperature after exposure to the sun in midsummer for several hours?

1. man
2. bird
3. dog
4. lizard
5. kangaroo.

19. Haemoglobin molecules in the red blood corpuscles have a greater affinity for carbon monoxide than for oxygen. People may die of carbon monoxide poisoning after exposure to car exhaust fumes and this is because the

1. oxygen-carrying capacity of the blood is decreased
2. oxygen-carrying capacity of the blood is unaffected
3. oxygen-carrying capacity of the blood is increased
4. carbon dioxide-carrying capacity of the blood is decreased
5. carbon dioxide-carrying capacity of the blood is increased.

20. Which of the following is true of all enzymes?

1. enzymes catalyze uphill reactions
2. enzymes cease their actions if the nucleus is removed from the cell
3. enzymes are proteins
4. enzymes are not affected by high temperatures
5. enzymes have all of the above properties.

See page 9

Questions 21 and 22 are based on the following information:

In studying the disease called "sleeping sickness", a scientist found some protozoan organisms (later named Trypanosoma) in the blood of a patient who had the disease. He put forward the hypothesis that this organism caused "sleeping sickness" in humans.

21. To test this hypothesis the scientist should

1. try to kill the Trypanosoma
2. examine other parts of the body of the patient for Trypanosoma
3. look for Trypanosoma in other animals
4. look for Trypanosoma in the blood of other patients with "sleeping sickness"
5. examine the blood of healthy people for Trypanosoma.

22. While examining other animals, the scientist located Trypanosoma in the salivary glands of a blood-sucking fly, Glossina. Which of the following would be most useful in providing evidence about the spread of Trypanosoma?

1. let an uninfected fly bite a healthy man
2. let an uninfected fly bite an infected man
3. let an infected fly bite an infected man
4. let a fly feed on a healthy man and then bite an infected man
5. let a fly bite an infected man and then feed on a healthy man.

23. A population of deer was threatened with overpopulation until a number of cheetahs was imported. After several generations there were fewer deer, but the average running speed of the deer population had increased significantly. This is an illustration of

1. population explosion
2. natural selection
3. induced mutation
4. environmental conservation
5. inheritance of acquired characteristics.

24. Some lizards closely resemble the colour of the vegetation where they live. This is probably because

1. there is a carefully designed plan in nature that fits each organism for its place in the environment
2. all mutations act to fit an organism to survive in its environment
3. this colour provides more warmth than other colours
4. in earlier generations, the lizards nearest this colour were the ones which survived and reproduced.

See page 10

25. A hermaphrodite animal is one which

1. develops both ovaries and testes in the one individual
2. reproduces asexually
3. is a parasite
4. is host to a parasite
5. reproduces parthenogenetically.

26. An adaptive structure, such as the elongated hind leg of a grasshopper, can best be described as

1. an acquired characteristic of an organism which allows that organism to successfully exist in its environment
2. an inheritable trait of an organism which provides that organism with the means to succeed in its environment
3. the ability to continually adjust to the changing environment
4. both 1 and 2.

27. Paramoecium is a small fresh-water protozoan. Its large surface to volume ratio is an advantage because it

1. increases the rate at which water can enter the animal
2. allows greater increase in size
3. permits rapid diffusion between the animal and its environment
4. prevents the animal's temperature from changing too rapidly
5. permits greater mobility.

28. If a live salt-water crayfish is put into a tub of fresh water it will die because

1. there is less oxygen in fresh water than there is in salt water
2. salt water animals cannot live in fresh water
3. there is no plankton in fresh water
4. environmental temperature fluctuations are greater in fresh water than in salt water
5. the pressure in its body cells increases.

29. Hydrolysis is a process in which complex sugars are reduced to less complex materials. This process involves the

1. production of water as a by-product
2. removal of water from complex sugar molecules
3. addition of water to complex sugar molecules
4. dissolving of complex sugar molecules in water
5. breakdown of water molecules.

See page 11

Questions 30 and 31 are based on the following information:

A lizard was placed in a heated trough until its body reached a steady temperature. It was then transferred to a ventilated container at a different temperature. The time was recorded for its temperature to fall to within 3^{o} of the container temperature. This procedure was repeated several times with the same lizard at a number of different temperatures.

The results are shown below:

Experiment	Trough temperature (^{o}C)	Lizard temperature (^{o}C)	Container temperature (^{o}C)	Lizard's lower temp. (^{o}C)	Time for temp. change (minutes)
P	30	32	10	13	20
Q	40	42	15	18	35
R	50	52	10	13	20
S	60	62	15	18	25

30. In which experiment did the lizard lose most heat?

1. Experiment P
2. Experiment Q
3. Experiment R
4. Experiment S

31. Which experiment shows the most rapid rate of heat loss?

1. Experiment P
2. Experiment Q
3. Experiment R
4. Experiment S

32. The advantage of asexual reproduction from an evolutionary point of view is that

1. all the offspring will be well suited to the same environment as that inhabited by the parents
2. dispersal into new environments is made easier
3. there is less chance of the offspring showing a new double-recessive character
4. it allows plant breeders to produce genetically uniform crops

See page 12

33. Crinia is a small frog found in swamps which dry up in summer. Two collections of Crinia were made, one from Western Australia and the other from south eastern Australia. Although they were very similar in appearance, it was suggested that these two samples belonged to two different species. The best way to test this suggestion is to

1. study more frogs from the same areas
2. find Crinia in other areas and study their characteristics
3. transfer Western Australian frogs to the eastern states and determine whether they grow and reproduce there
4. determine the degree of similarity between the tadpoles of the two populations
5. allow the frogs to interbreed and see if the offspring are fertile.

Questions 34 and 35 relate to a biologist's study of human reproduction.

34. The biologist hypothesizes that the pituitary gland and ovary influence each other in producing the uterine cycle in females. Which of the following observations would best support this hypothesis?

1. Removal of the ovary is followed by degeneration of the uterus
2. Removal of the pituitary gland is followed by death
3. The ovary produces hormones
4. The pituitary obviously controls a large number of body functions
5. Uterine development takes place only when both the pituitary and ovary are present.

35. Which of the following procedures would provide the best test of the biologist's views?

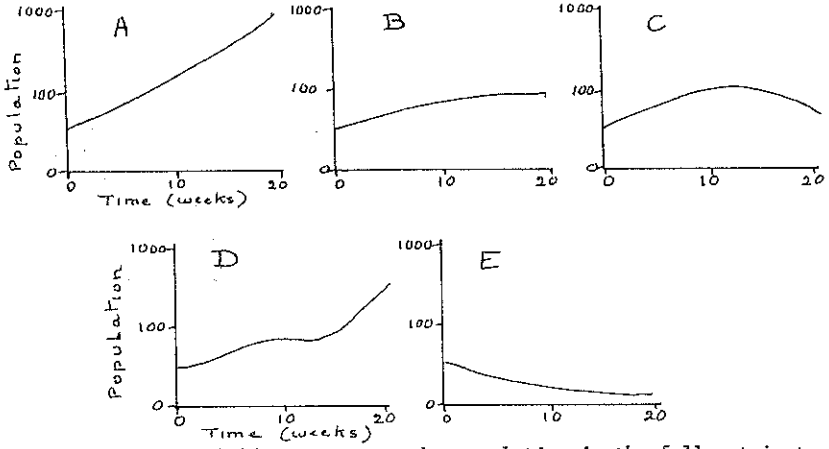
1. Investigate all of the endocrine glands of the body
2. Note what happens to the uterus when varying amounts of pituitary and ovarian secretions are injected into the body
3. Compare the amounts of pituitary and ovarian secretions produced under identical conditions
4. Determine the relative acidity of hormones secreted from the pituitary and the ovary
5. Keep a careful daily record of uterine changes following fertilization.

See page 13

Questions 36 and 37 are based on the following information:

In a laboratory experiment duckweed plants were grown in several jars. One jar contained full nutrient solution, while in each of the others a different mineral element was left out. No jar was completely filled with weed by the end of the experiment.

The results of successive weekly population counts were graphed on semi-logarithmic paper as shown below:



36. Which graph probably represents the population in the full nutrient solution?

1. Graph A
2. Graph B
3. Graph C
4. Graph D
5. Graph E.

37. It was suspected that one of the deficient solutions became contaminated with the deficient element during the experiment. This was probably the solution represented by

1. Graph A
2. Graph B
3. Graph C
4. Graph D
5. Graph E.

See page 14

Questions 38 and 39 are based on the following information:

If you fill a clean jar with rainwater immediately after a shower and study the water under a microscope, you find practically no life in it. A few days afterwards it is teeming with organisms but two weeks later there are quite different species present.

38. This information illustrates

1. a food web
2. succession
3. evolution
4. a food chain
5. a food pyramid.

39. The change in the species present occurs because

1. the first species exhaust their food supply and die out
2. the oxygen supply is depleted
3. the rainwater is inoculated from the surroundings during the first few days
4. different species take varying lengths of time to develop
5. each community formed alters the environment, enabling other organisms to become established.

40. In which of the following would you expect to find the haploid number of chromosomes?

1. skin of a human embryo
2. liver cells
3. brain cells
4. tissue which heals a cut in your finger
5. sperm cell.

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SECTION B.

Suggested time: 75 minutes (36 marks)

Attempt ALL the questions in this section.

Write your answers in the spaces provided.

41.
(5 marks)

You are required to determine whether there is an increase in organic material in a batch of seedlings during a long period of continuous light supply. Which one of the following procedures, carried out on successive samples of the population, would provide the most useful evidence?

Write down your chosen answer and briefly explain why you have selected it.

1. Determination of the fresh weight of the seedlings
2. Measurement of the height of the seedlings
3. Determination of the starch content of the seedlings
4. Determination of the dry weight of the seedlings.

See page 16

42.
(16 marks)

A research scientist was studying the ecological adaptations of the Australian shrub Rhagodia baccata. To determine the rate of transpiration he measured the amount of water lost from leaves during a 24 hour period in June and in a similar period in February. In each experiment he also measured the amount of water evaporated from a piece of blotting paper under the same conditions. The water loss from leaves (measured in $mg/cm^2/minute$) was as follows:

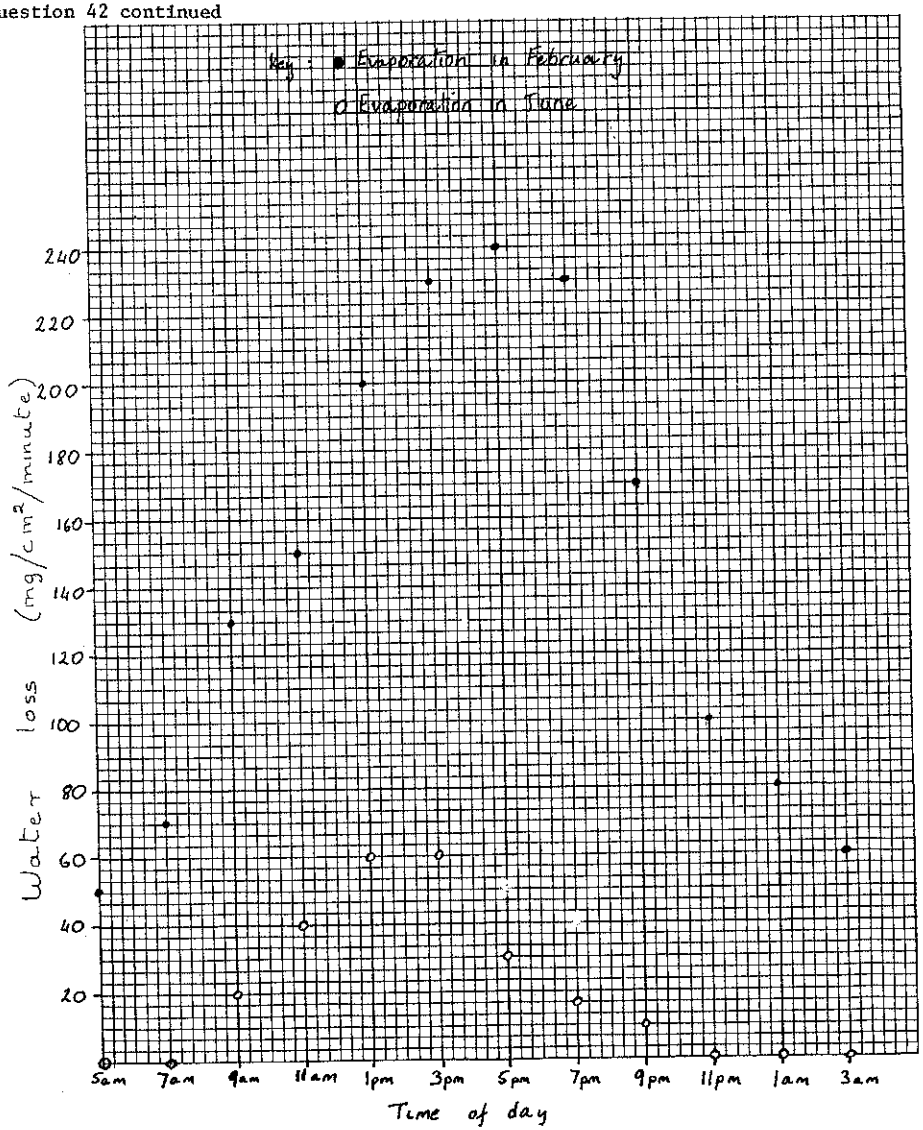
Time of day	5am	7am	9am	11am	1pm	3pm	5pm	7pm	9pm	11pm	1am	3am
February water loss	5	30	35	5	5	5	30	10	5	5	5	5
June water loss	0	0	10	25	60	65	5	0	0	0	0	0

(a) Plot the February and June water loss figures for the leaves on the graph provided. The figures for evaporation from the blotting paper have already been plotted on page 17. Draw in the graphs for each of the 4 sets of figures.

(b) Suggest an hypothesis to account for the difference in transpiration rates between June and February.

See page 17

Question 42 continued



See page 18

Question 42 continued

(c) How would you test the hypothesis you suggested in (b)?

(d) While studying photosynthesis in the same plant, the scientist found that the fastest rate of photosynthesis occurred at 30°C. Assuming that the enzymes were not destroyed below 50°C, what could have prevented an increase in photosynthesis at temperatures above 30°C?

(e) What method do you think that the scientist would have used to measure the transpiration rate of the leaves?

See page 19

43.
(3 marks)

In 1938, with a population of 6,936,000, Australia had a birth rate of 9.59, an immigration rate of 2.82 and an emigration rate of 1.65 per thousand individuals.

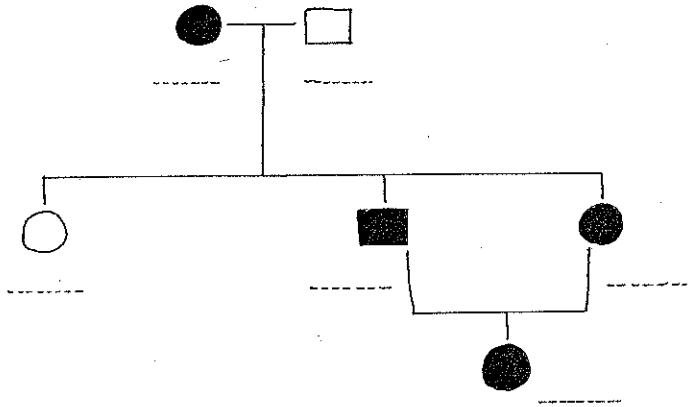
Calculate the rate of increase per thousand of population.

How many individuals would there have been in 1939?

44.
(4 marks)

Black coat colour of guinea pigs is a dominant trait and white is the alternative recessive trait. In the following pedigree, circles represent females, squares represent males and black shading indicates black coat colour.

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

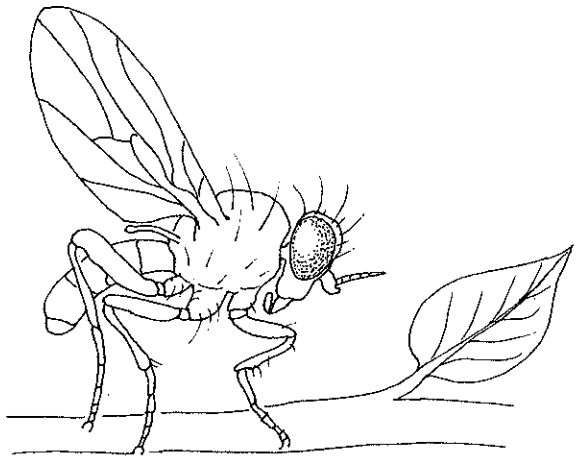


(b) If a black female guinea pig is crossed to a white male and all offspring are black, what do you consider is the genotype of this female?

See page 20

45.
(4 marks)

Determine the order to which this insect 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.



KEY.

( )	1a.	Soft-bodied, pale insects parasitic on the feathers of birds or the hair of mammals ..	2
( )	1b.	Other insects. If parasitic on the bodies of birds or mammals then not particularly soft-bodied or pale	3
( )	2a.	Tubular, sucking mouthparts. Sucking lice ..	Order Anoplura
( )	2b.	Biting mouthparts. Biting lice	Order Mallophaga
( )	3a.	Body strongly compressed from side to side; hind legs long and fitted for leaping. Parasitic on the bodies of birds or mammals. Fleas	Order Siphonaptera
( )	3b.	Body not strongly compressed from side to side, not parasitic on birds and mammals	4

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( )	4a.	Minute insects, with pale soft bodies, found amongst old books and papers or neglected museum specimens; rapid runners. Booklice	Order Psocoptera
( )	4b.	Larger insects of different appearance and habits	5
( )	5a.	Mouthparts of biting type	6
( )	5b.	Mouthparts not of biting type	9
( )	6a.	Hind legs much longer than other legs, and suited to leaping. Wingless grasshoppers .	Order Orthoptera
( )	6b.	All legs more or less equal in length .. .	7
( )	7a.	Pale, soft-bodied, slow-moving insects tunnelling in soil or timber, often living in colonies made up of several distinct castes. Termites	Order Isoptera
( )	7b.	Insects differing in appearance and habits from 7a	8
( )	8a.	Large, broadly flattened insects with legs pressed close to the body; usually rapid runners. Head partly or completely hidden when viewed from above. Wingless cockroaches .	Order Dictyoptera
( )	8b.	Elongated stick-like insects with the first segment of the thorax (the segment bearing the front legs) short and the second segment of thorax very long. Phasmatids .	Order Phasmida
( )	9a.	Abdomen constricted to form a "wasp waist". Ants and wingless wasps	Order Hymenoptera
( )	9b.	Abdomen broadly joined to thorax (no "wasp waist")	10
( )	10a.	Very furry slow-moving insects with an abdomen much larger than head and thorax. Some female moths	Order Lepidoptera
( )	10b.	Insects without a hairy covering	11
( )	11a.	Very small slow-moving insects with long thin legs. Abdomen with a pair of short tubes on the back, through which wax is secreted. Aphids	Order Homoptera
( )	11b.	Insects of different form, without tubes on the back	12
( )	12a.	Head with a distinct neck	Order Diptera
( )	12b.	Head usually set into thorax. Many bugs .	Order Hemiptera

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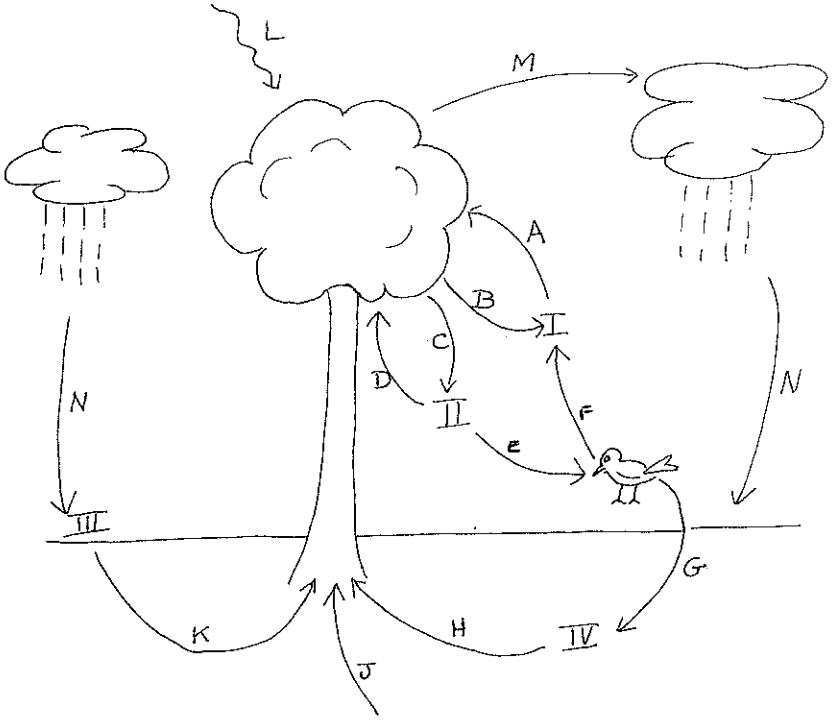
46.
(4 marks)



The above diagram represents some of the relationships in biogeochemical cycles. The roman numerals I, II, III and IV represent compounds.

Answer the following questions by writing the necessary terms in the appropriate spaces left for this purpose.

(a) The group of organisms which is responsible for converting the materials at G, IV to H (a form which is useable by the plant), is called the -

_____

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46 continued.

(b) The most significant chemical element in the materials at IV and H is

_____

(c) Arrows B, D, E and F represent the cycling of materials as a result of the process occurring in plants and animals called

_____

(d) Photosynthesis uses product I, which is

_____

(e) Energy flow and material cycling become most closely related when radiant energy at L is converted by the tree to chemical energy in the form of _____ in the plant tissues.

(f) In order for the plant to carry on the process of photosynthesis substance III, which is _____, along with all the substances (arrow J) which are collectively called _____ must enter through the root system.

(g) Arrows M and N are part of the _____ cycle.

See page 24

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.

47. EITHER (a) A state of equilibrium can exist within a natural bushland and within an agricultural ecosystem. Describe how the clearing of bushland for pasture could lead to the destruction of the equilibrium and explain what measures can be taken to prevent erosion and increased salinity of the soil water.

OR (b) Relatively high concentrations of pesticide residues have been found in the fatty tissues of Antarctic penguins. With the help of a food pyramid, explain how pesticides sprayed on to agricultural crops could reach the penguins.

48. EITHER (a) "Parasites, both plant and animal, show a wide range of special modifications for successful existence in or on a host and for continuation of the species".

Explain this statement using either plants or animals as examples.

OR (b) What are the main differences in the physical conditions to be found in (i) a terrestrial habitat and (ii) a fresh-water habitat?

Explain the adaptations of living organisms necessary for survival on land.

END OF PAPER