



TERTIARY ENTRANCE EXAMINATION, 1990
QUESTION/ANSWER BOOKLET

BIOLOGY

Please place one of your student
identification labels in this box

STUDENT SEA NUMBER—In figures

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In words

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TIME ALLOWED FOR THIS PAPER

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

MATERIAL REQUIRED/RECOMMENDED FOR THIS PAPER

TO BE PROVIDED BY THE SUPERVISOR

This Question/Answer Booklet comprising 33 pages and 39 questions
Separate Multiple Choice Answer Sheet
Standard Answer Book
Paper binder

TO BE PROVIDED BY THE CANDIDATE

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

IMPORTANT NOTE TO CANDIDATES

No other items may be taken into the examination room.

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

SEE PAGE 3

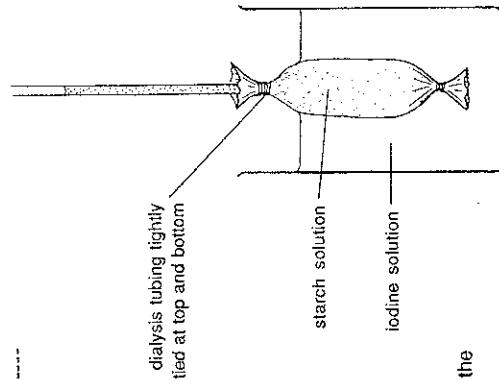
SECTION A

Suggested time: 40 minutes (30 marks)

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

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

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



1. In the system illustrated here, a bag made from dialysis (cellophane) tubing filled with a starch solution is immersed in an iodine solution in a beaker.

Shortly after being immersed, the level of the liquid in the tube will be rising because

- (a) more iodine molecules will be entering the bag than starch molecules will be leaving.
- (b) more starch molecules will be leaving the bag than iodine molecules will be entering.
- (c) more water molecules will be entering than will be leaving the bag.
- (d) more water molecules will be leaving than entering the bag.

2. The final result after the experiment in Q1 is caused by

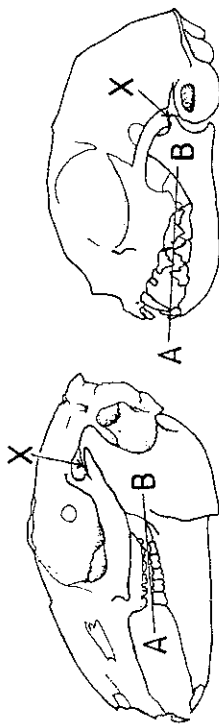
- (a) brownian movement (ie the random movement of particles in solution).
- (b) forces of capillarity and cohesion.
- (c) only water molecules moving across the dialysis tubing.
- (d) water and iodine moving across the dialysis tubing.

SEE PAGE 5

3. Plants growing in very hot arid environments reduce their photosynthetic activity during the middle hours of the day because

- (a) no water is available for photosynthesis.
- (b) when transpiration is high, stomata close thus no carbon dioxide can penetrate into the air spaces in the leaf.
- (c) the photosynthetic enzymes are inactivated by the high temperature.
- (d) at high light intensities, guard cells become turgid.

4. The figures below show skulls of two different mammals, illustrating how jaw structure is modified to function in two quite different feeding methods. The arrow X marks the point of articulation between the upper and lower jaws, and the line AB indicates the level of teeth in the lower jaw.



The animal will grind, instead of cutting, its food if

- (a) point X is well above the line AB.
- (b) point X is just above the line AB.
- (c) point X is just below the line AB.
- (d) point X is well below the line AB.

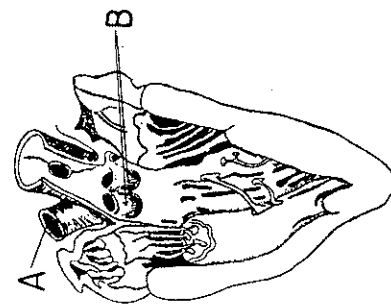
The diagram of the sheep's heart refers to Questions 5 and 6.

5. Blood passing through structure A would be

- (a) supplying the heart.
- (b) entering the heart.
- (c) passing to the lungs.
- (d) passing to the body.

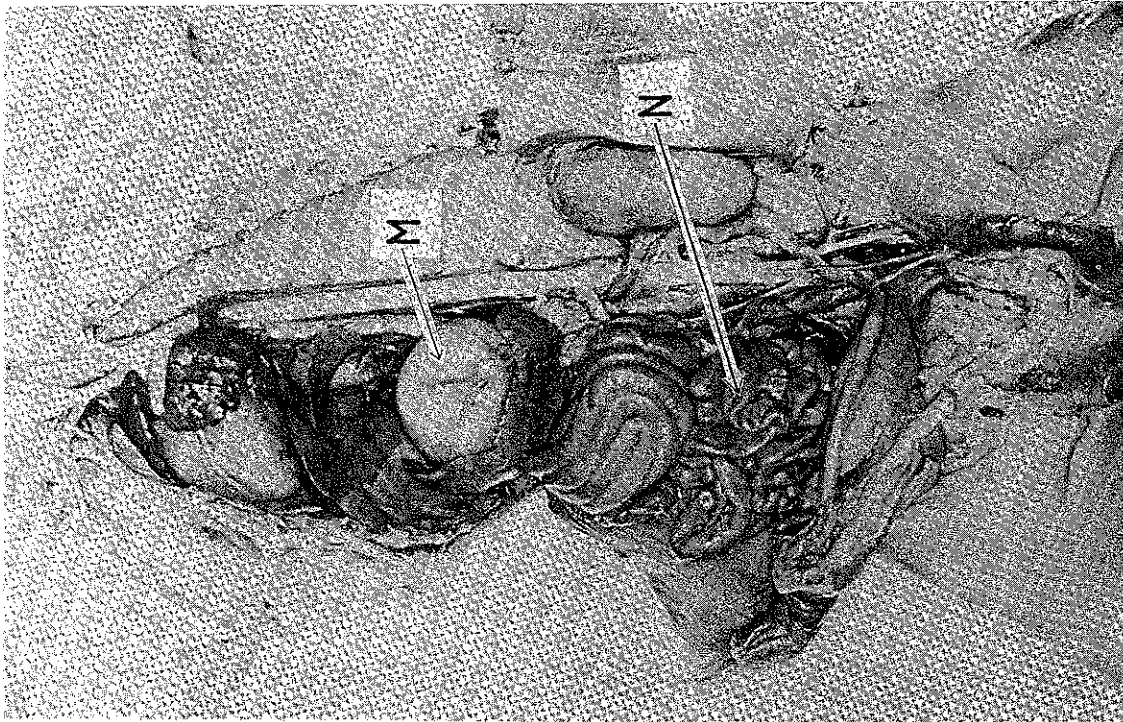
6. The purpose of structure B is to

- (a) maintain the pressure on the blood.
- (b) prevent back flow.
- (c) oxygenate the blood.
- (d) ensure the blood passes to the head.



SEE PAGE 6

The photograph below of the dissected vertebrate refers to Question 7.



SEE PAGE 7

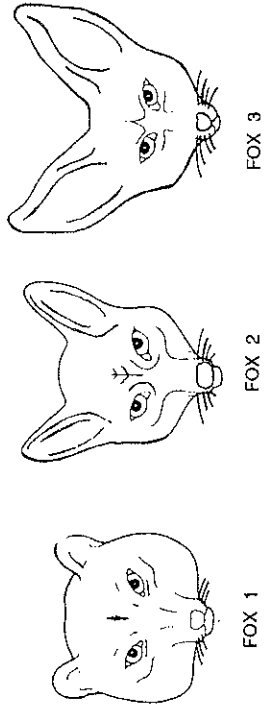
7. If samples of the contents of structures M and N were extracted

- (a) the acid concentration would be higher in M than N.
- (b) the acid concentration would be higher in N than M.
- (c) they would have about the same acid concentration.
- (d) the oxygen concentration would be higher in M than N.

8. The gas exchange surfaces of mammals (eg dogs) and insects (eg cockroaches) have a number of structural features in common. One of these similarities is that both

- (a) have a large surface area.
- (b) are supported by chitin.
- (c) are thin and dry.
- (d) are supplied with blood vessels.

9. The structure of an organism is related to the environment in which it lives. Examine the diagrams of the three fox species below.



Which of the following sets of temperatures would you expect to be closest to the average (normal) temperature experienced by each of the species?

	Fox 1	Fox 2	Fox 3
(a)	25°C	12°C	0°C
(b)	0°C	25°C	12°C
(c)	25°C	0°C	12°C
(d)	0°C	12°C	25°C

SEE PAGE 8

10. Which of the following structure(s) in onion cells would be more distinct after staining by iodine?

(a) Ribosomes.
(b) Nucleus.
(c) Chloroplast.
(d) Cell membrane.

11. Which of the following is true of all cells?

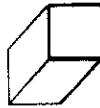
(a) Cells are basically the same in structure, yet differ in shape and function.
(b) Cells have a cell wall and a definite nuclear membrane.
(c) Cells differ greatly from organism to organism.
(d) Cells have chloroplasts for making food.

The information below refers to questions 12 and 13.

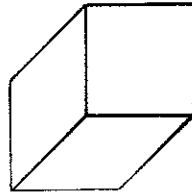
A student wanted to investigate the relationship between cell size and the rate at which substances enter cells. For his investigation he cut a potato into cubes of 3 different sizes: cube 1 was 5 mm³, cube 2 was 10 mm³, and cube 3 was 20 mm³. The cubes were then covered in iodine for 5 minutes, after which they were removed and cut in half.



CUBE 1



CUBE 2



CUBE 3

12. Which cube had the smallest surface area to volume ratio?

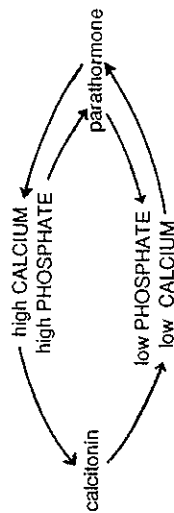
(a) Cube 1.
(b) Cube 2.
(c) Cube 3.
(d) They would all be the same.

13. Which cube would have the largest proportion of its contents coloured by the iodine?

(a) Cube 1.
(b) Cube 2.
(c) Cube 3.
(d) None, as iodine is too large to enter the cell.

SEE PAGE 9

14. The hormones parathormone (produced by the parathyroid glands) and calcitonin (produced by the thyroid) work in opposition to each other to regulate blood CALCIUM and PHOSPHATE levels as shown



Activation of the thyroid gland will lead to

(a) high CALCIUM, high PHOSPHATE blood levels.
(b) high CALCIUM, low PHOSPHATE blood levels.
(c) low CALCIUM, high PHOSPHATE blood levels.
(d) low CALCIUM, low PHOSPHATE blood levels.

15. The rat poison Warfarin was extremely effective when it was first introduced, but in recent years its effectiveness in some countries has declined. The change probably came about because

(a) rats are unusually hardy animals.
(b) continual exposure to Warfarin made the rats immune to its effects.
(c) rats resistant to Warfarin survived and reproduced.
(d) Warfarin is more effective in some climates than in others.

16. Which of the following cell organelles would you expect to be LESS numerous in a bone cell than in a skeletal muscle cell?

(a) Mitochondria.
(b) Nuclei.
(c) Vacuoles.
(d) Ribosomes.

17. Chloroplasts extracted from leaf cells can be made to produce oxygen from water when they are illuminated. It can be concluded that chloroplasts

(a) are sites of photosynthetic starch production.
(b) use light energy to split water.
(c) are chiefly active in oxygen metabolism.
(d) only function effectively in intact leaf cells.

SEE PAGE 10

Questions 18 and 19 refer to the following information.

In an experiment to test the effect of temperature on the action of the enzyme amylase in saliva, six test tubes containing saliva and starch were placed in water baths at the following temperatures: 0°C 27°C 37°C 50°C 70°C 100°C at the commencement of the experiment.

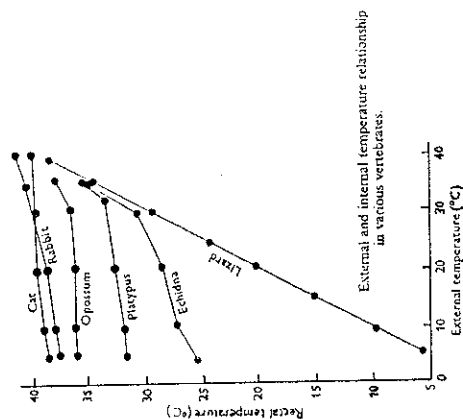
18. After 10 minutes, to test for the presence of glucose, Benedict's solution was added to each tube and then it was heated. In which tube would you expect to find the greatest reaction?

- (a) The tube at 27°C.
- (b) The tube at 37°C.
- (c) The tube at 100°C.
- (d) They would all be the same.

19. The students tested their saliva with glucose sensitive test tape before starting. Which student's saliva would they use?

- (a) One which gave no reaction to test tape.
- (b) One which gave a strong reaction to test tape.
- (c) One which gave a mild test to test tape.
- (d) One which caused the test tape to turn green.

Questions 20 and 21 on the page opposite refer to the graph below.



SEE PAGE 11

20. The graph opposite shows that

- (a) the temperature of a cat is higher than that of a rabbit.
- (b) lizards always feel cold to the touch.
- (c) echidnas generate more heat than lizards.
- (d) the platypus loses control of body temperature at external temperatures above 30°C.

21. At 20°C environmental temperature, the temperatures of the opossum and lizard, respectively, would be

- (a) 10°C and 32°C.
- (b) 18°C and 27°C.
- (c) 26°C and 10°C.
- (d) 36°C and 20°C.

22. Animals such as the rabbit which control their body temperatures

- (a) cannot live in cold climates.
- (b) use little food energy in the production of heat.
- (c) have more difficulty in keeping cool than in keeping warm.
- (d) have complex nervous regulatory systems.

23. A few species of marsupials occur on the American continent, but the greatest variety and number is confined to the Australian land mass. The best reason for this distribution of marsupials is

- (a) they evolved in greater numbers in Australia than in any other part of the world.
- (b) they originated in Australia and only migrated to the American continent.
- (c) their evolution in Australia was not affected by competition with placental mammals.
- (d) they originated in Asia and migrated to America and Australia.

24. Which of the following sources of information would be LEAST helpful in determining why marsupials are unevenly distributed? Studies of

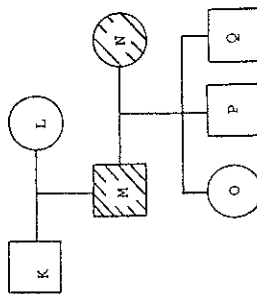
- (a) existing habitats containing both marsupials and placentals.
- (b) the fossil record.
- (c) marsupial and placental reproductive systems.
- (d) changes in sizes and position of continents and land bridges of the past.

SEE PAGE 12

25. People who live in Arctic regions are generally able to withstand very low temperatures better than people who live in temperate regions. One could reasonably predict that

- (a) if this trait is under genetic control, then people who live in Arctic regions would have offspring who also show the trait.
- (b) if this trait is under genetic control, then an adult born and reared in Arctic conditions would no longer show the trait if he moved to a temperate region.
- (c) if this trait is acquired, people who previously lived in Arctic regions but have shifted to temperate regions would have offspring who show the trait.
- (d) if this trait is acquired, then an adult who previously lived in Arctic regions would continue to show the trait if he moved to a temperate region.

The diagram below, relevant to Questions 26 and 27, represents the pedigree of a family in which members M and N can taste the substance PTC. The remaining members of the family cannot.



26. It was suggested that the ability to taste PTC is due to a dominant gene.

The suggestion is refuted by the observation that

- (a) M's father is not a taster.
- (b) none of M's parents was a taster.
- (c) both males and females can be tasters.
- (d) none of M and N's children are tasters.

27. From the pedigree, we can definitely say that N

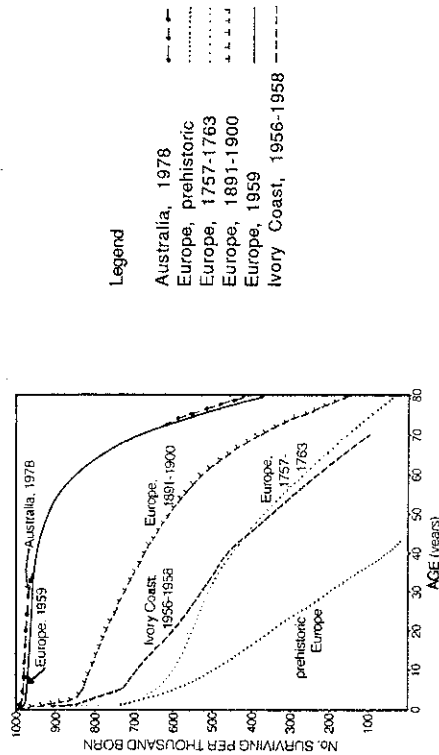
- (a) is heterozygous for both alleles.
- (b) has at least one dominant allele.
- (c) is homozygous dominant.
- (d) is homozygous recessive.

SEE PAGE 13

28. Features used to classify humans as primates include

- (a) high internal heat production; nails instead of claws; forward facing eyes.
- (b) forward facing eyes; mammary glands; comparatively large brain.
- (c) high internal heat production; comparatively large brain; hair.
- (d) nails; forward facing eyes; comparatively large brain.

29. The graph shows the number of people surviving at different ages for every 1000 persons born.

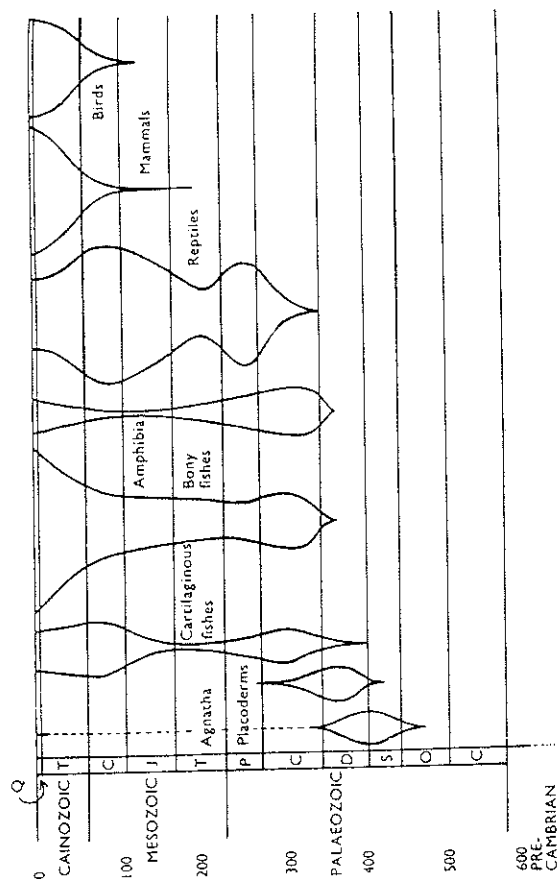


By reference to the graph, which of the following statements is most accurate?

- (a) People in pre-historic Europe lived longer due to less polluted environments.
- (b) Modern agricultural practices have improved the nutritional status of all humans since the beginning of this century.
- (c) People in Australia live shorter lives now than 80 years ago because of increasing rates of cancer and stress related diseases.
- (d) 80% of Australians can expect to live longer than 60 years of age.

SEE PAGE 14

30. The figure below shows the relative abundance of vertebrates in the fossil record.



The figure shows that

- (a) life evolved in the oceans.
- (b) mammals and then birds are the last to appear in the fossil record.
- (c) during the Mesozoic, the most numerous organisms were bony fishes.
- (d) the first vertebrates to appear were birds.

SEE PAGE 16

SEE PAGE 16

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NOTE: SECTION B COMMENCES ON P.16

SECTION B

Suggested time: 90 minutes (46 marks)

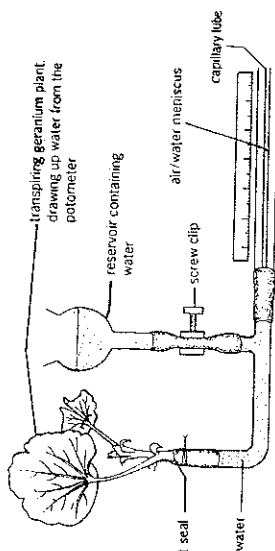
Attempt all questions in the section.

Write your answers in the space provided.

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

31. (9 marks)

With reference to the experimental set-up:



(a) What differences would you expect to find in the rate of water loss from the plant

i) if the plant were encased in a plastic bag? (1 mark)

ii) if the plant were enclosed in a plastic bag containing calcium chloride which absorbs water? (1 mark)

iii) If the plant were exposed to a stream of hot air for 30 minutes? (1 mark)

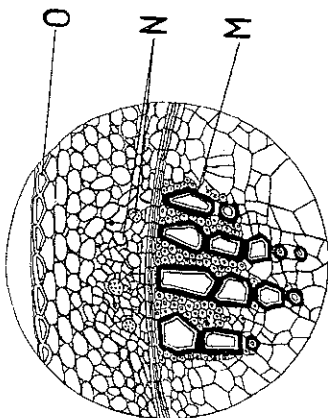
iv) Explain your answer in part a (iii) above. (2 marks)

SEE PAGE 17

31. (continued)

The stain, acid phloroglucinol, can be used to differentiate between stem tissues. When using this stain, phloem will be blue, cellulose light blue, and xylem yellow or pink.

A transverse section of a stem is cut and stained with acid phloroglucinol as shown in the diagram at right.



(b) What colour would the following regions stain? (1 mark)

M

N

O

(c) Why has the xylem stained a different colour to the phloem? (1 mark)

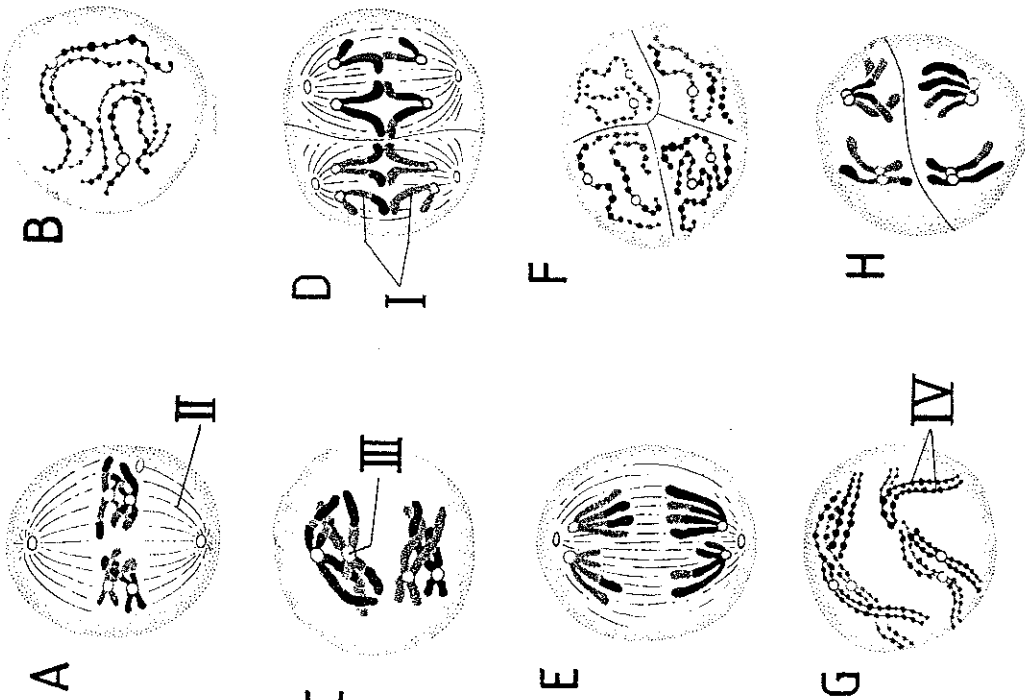
(d) In which of the regions labelled above would substances be translocated from the leaves to the roots? (1 mark)

(e) In which region would active mitosis be occurring? (1 mark)

SEE PAGE 18

32. (6 marks)

The diagram illustrates chromosomes from a cell in stages of meiosis.



SEE PAGE 19

32. (continued)

The sequence has been jumbled.

(a) Write the letters in the appropriate space to indicate the correct sequence for the process. (2 marks)

First stage _____ Second stage _____ Third stage _____
Fourth stage _____ Fifth stage _____ Sixth stage _____
Seventh stage _____ Eighth stage _____

(b) Indicate below which labels of the diagrams represent the following structures. (2 marks)

centromere _____ chromatids _____
homologous chromosomes _____ aster _____

(c) In which stage does crossing-over occur? (0.5 mark)

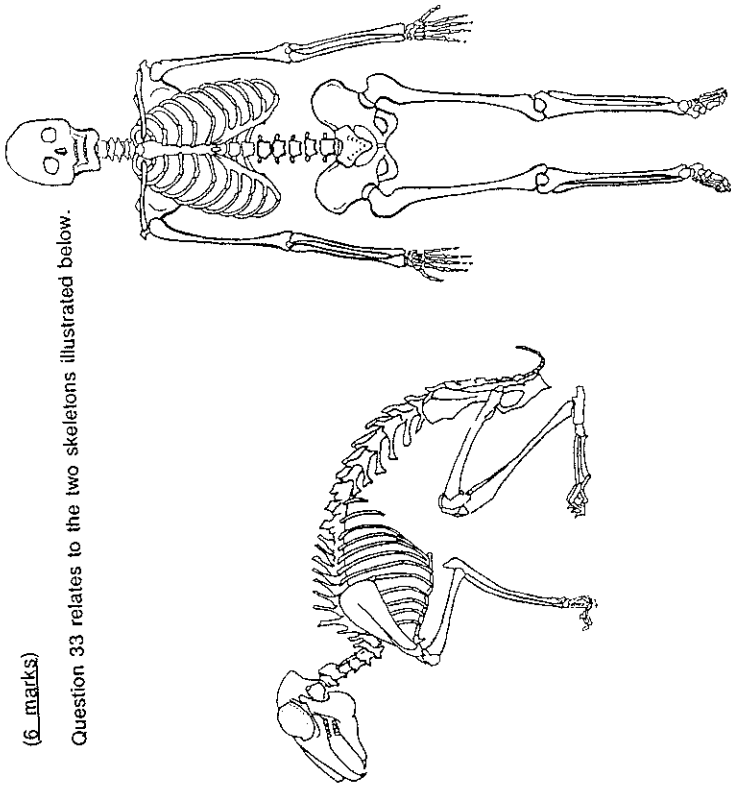
(d) Where in the following examples does this process occur? (1.5 marks)

i) humans: _____ and _____
ii) ferns: _____ and _____
iii) flowering plants: _____ and _____

SEE PAGE 20

33. (6 marks)

Question 33 relates to the two skeletons illustrated below.



SKELETON 1

SKELETON 2

- (a) List **two** differences between the skeletons which are related to the methods of locomotion of these animals. (2 marks)

SEE PAGE 21

33. (continued)

- (b) Identify the difference between the human and the rabbit in the placement of the eye sockets. What is the significance of this difference? (1 mark)

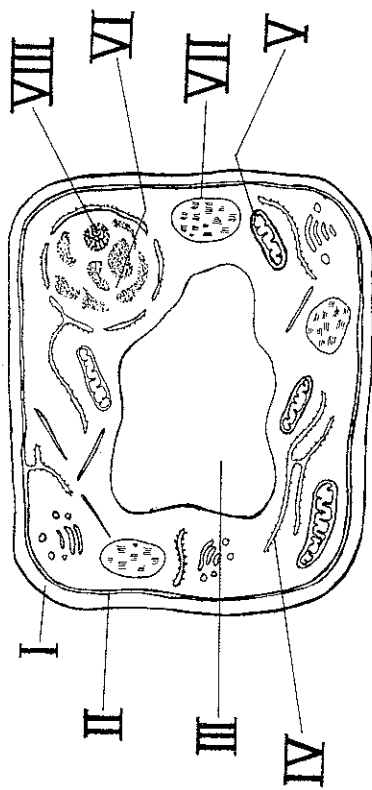
- (c) How does the size of the brain case in proportion to body size of the human compare with that of the rabbit? (1 mark)

- (d) Give **two** advantages to the human's way of life that result from this difference in brain proportion to body size. (2 marks)

SEE PAGE 22

34. (5 marks)

Below is a diagram illustrating the structure of a cell as seen using an electron microscope.



(a) Write labels beside the numbers to identify the structures indicated on the diagram. (2 marks)

- I _____
- II _____
- III _____
- IV _____

(b) What is the chief function of the structure labelled (V) in the diagram above? (0.5 mark)

(c) If organelle (VI) was removed from the cell without excessive damage, what effect would this have on the function of the cell (2 marks)

i) in the short term? _____

SEE PAGE 23

34. (c) (continued)

ii) for its long term survival? _____

(d) A chemical compound is said to be 'labelled' when some of its atoms are radioactive. The compound can then be detected using photographic plates or radioactivity counters. If the cell above was supplied with 'labelled' glucose for a short time, which of the organelles above would show the most radioactivity? (0.5 mark)

35. (3 marks)

(a) What is the significance of the enormous surface area of capillaries in the body? (1 mark)

(b) Suppose that substances could pass readily through the walls of arteries and veins. Would a circulatory system that consisted entirely of these vessels be adequate for the needs of body cells? (1 mark)

Explain _____

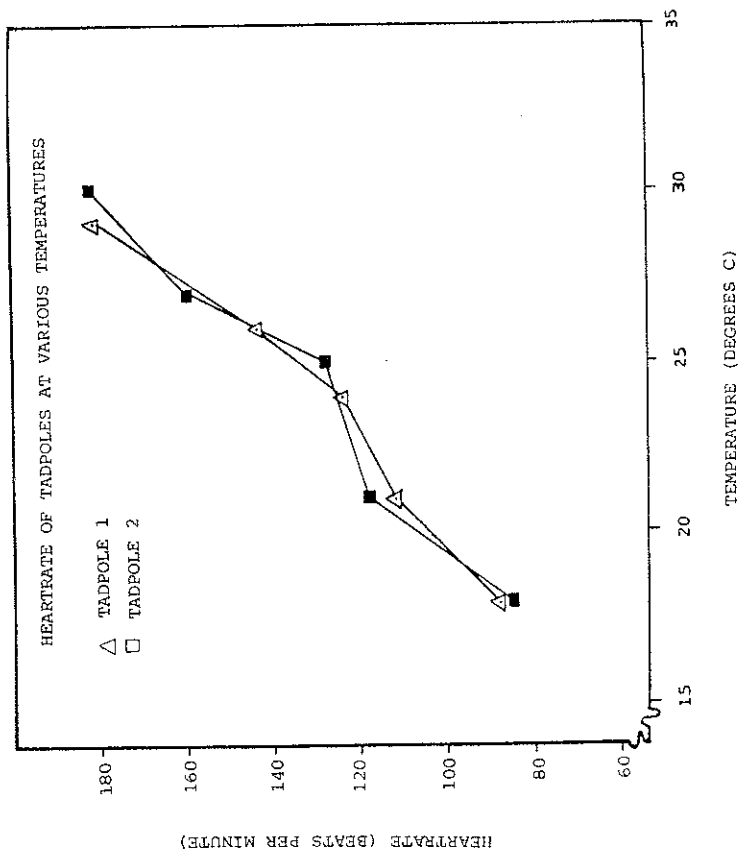
(c) Some invertebrate animals have blood systems in which there are no veins or capillaries. Blood escapes from the ends of the arteries and returns to the heart through the intercellular and inter-organ spaces (called sinuses). What effect would this have on the effectiveness of transfer of substances around the body? (1 mark)

Explain _____

SEE PAGE 24

36. (10 marks)

Two students were investigating the rate of heartbeat of frog tadpoles at a range of temperatures. The data for two individual tadpoles are graphed below.



(a) Write a sentence which describes the relationship between heart rate and temperature. (1 mark)

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36. (continued)

(b) How could the investigation be made more reliable? (1 mark)

(c) Predict the average heart rate if the tadpoles were cooled to 16°C. (1 mark)

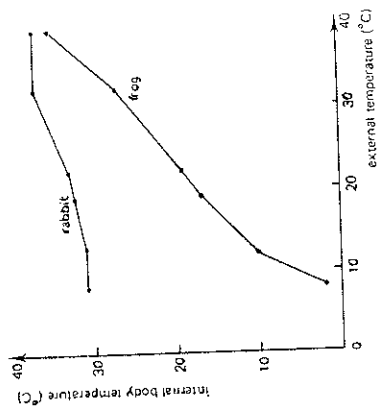
(d) Why does cooling affect the rate of biological activities such as the rate of heartbeat in the tadpole? (1 mark)

(e) It is recommended that these tadpoles should NOT be heated above 31°C since this may prove fatal. What are the effects of high temperatures that might be fatal to these animals? (1 mark)

SEE PAGE 26

36. (continued)

The following graph shows how the internal temperature of a warm blooded animal (a rabbit) and a cold blooded animal (a frog) changes with external temperature.



(1) What is the difference in temperature response between the internal body temperature of the rabbit and of the frog? (1 mark)

(9) Describe and explain the changes that take place in the skin of a rabbit when the external temperature approaches 40°C. (2 marks)

SEE PAGE 27

36. (continued)

(h) How will the behaviour of both the rabbit and frog be likely to differ when the external temperature drops to about 10°C? (2 marks)

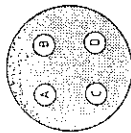
SEE PAGE 28

37. (7 marks)

In an experiment, agar was made up with hot water and starch and then iodine was added. The mixture was poured into a petri dish, left to set and four holes were cut into the jelly as shown below.



side view

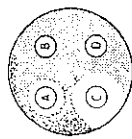


top view

In the table below, the asterisks indicate which substances were put into the holes in the dish. After filling, the dish was kept at 37°C for 24 hours.

Substance	A	B	C	D
Amylase (salivary enzyme)	*	*	*	*
Dilute hydrochloric acid		*	*	*
Dilute alkali	*	*	*	*
Water				*

The diagram below shows what the dish looked like at the end of this time.



top view, 24 hours later

(a) What was the colour of the mixture when it was poured into the petri dish? (0.5 mark)

(b) Why was the dish kept at 37°C? (0.5 mark)

(c) Explain what has happened to make the area around the holes A and C clear. (1 mark)

SEE PAGE 29

37. (continued)

(d) Does amylase work better in acid or alkaline conditions? (0.5 mark)

(e) Explain why only water was put in hole D. (1 mark)

(f) Compare hole A with hole C. What can you infer about the rate of amylase activity? (1 mark)

(g) If the dish had been kept at 20°C, would the clear area around hole C have been the same size? Explain your answer. (1.5 mark)

(h) Why did A work and not B? (1 mark)

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SECTION C

Suggested time: 50 minutes (24 marks)

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

USE THE SEPARATE ANSWER BOOK FOR SECTION C ANSWERS

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

38. EITHER

(a) The process by which plants manufacture food has been the subject of experimental study during the past four hundred years. Some of these past experiments can be easily repeated in a school laboratory.

- i) Describe an experiment which would show that chlorophyll is necessary for food manufacture to take place.
- ii) What evidence is there that the energy taken up by the chlorophyll is used in manufacture of organic compounds?

Photosynthesis and respiration are chemically opposite processes.

iii) Describe the physiological connection between these two metabolic processes.

iv) Illustrate by carefully labelled diagrams the sites within cells where the processes occur.

SEE PAGE 31

38. (continued)

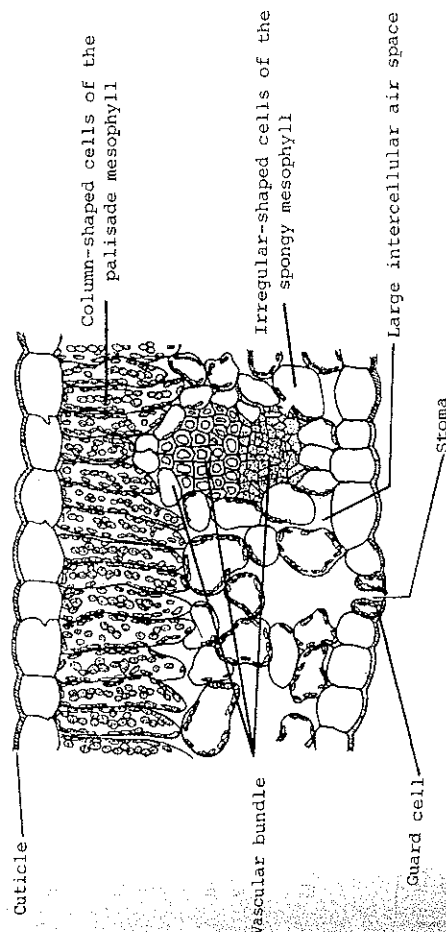
OR

(b) Metabolic activity results in the production of waste substances.

- i) In a mammal, describe both the processes which lead to the production of waste substances and also the organ systems and activities used to remove them from the body.
- ii) Most land-dwelling animals have internal respiratory surfaces. Explain why this is necessary.

OR

(c) Below is a labelled diagram of a microscopic section of a leaf from the canopy of a tall tree.



One major function of such a leaf is the manufacture of food by photosynthesis.

Explain how the structures illustrated in the diagram are designed so that the requirements of the photosynthetic process can be efficiently supplied and its products efficiently removed.

Describe the processes by which this leaf is supplied with non-gaseous materials from the roots.

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39. EITHER

- (a) 'In complex multicellular animals, integration and regulation of body processes is carried out: by **hormones**; or by **nervous tissue**; or by **hormones & nervous tissue** working in conjunction.'

Discuss this statement with reference to animals which you have studied in your course, making sure that you provide information to illustrate the parts of the statement which are emphasised.

OR

- (b) Using your knowledge of genetics, provide an explanation for each of the following:

- i) "Our poultry are carefully bred to ensure a uniformly high level of body weight for each bird, so that consistent cooking times can be used in their preparation."
- ii) "By crossing lupins from two different wild varieties, we were able to produce plants with a reduced level of unpleasant tasting alkaloids."
- iii) "Nectarines were developed when a young peach tree was found to produce fruit without the usual furry skin of normal peaches."
- iv) "Looking at them, you would never know that those two were twins"

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39. (continued)

OR

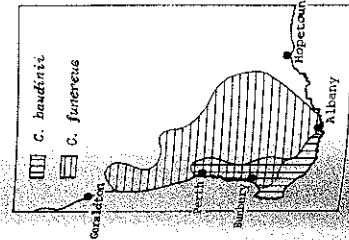
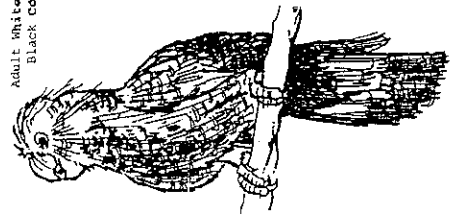
- (c) The White-tailed Black Cockatoos from the South-West of Western Australia have long held fascination for Dr Denis Saunders of the CSIRO Division of Wildlife and Ecology. There are two species of Black Cockatoo which may be seen about Perth during part of the year: the Short-billed *Calyptrorhynchus funereus*, which breeds in arid areas of sandplain and mallee in the wheatbelt; and the Long-billed *Calyptrorhynchus baudinii* which breeds in wetter areas such as the karri forests to the South.

Dr Saunders considers that *C. funereus* and *C. baudinii* arose from a common ancestor. Both species have different food preferences, and different contact calls.

- i) What factors cause variation within a population?
- ii) Explain how such genetic differences became established in the two cockatoo species.

Significant areas of the sandplain and mallee habitats in the wheatbelt have been cleared and the areas remaining might be threatened by greenhouse changes.

- iii) What are the likely genetic consequences for *C. funereus* if this habitat is lost quickly?

Adult White-tailed
Black CockatooSkull of
Short-billed CockatooSkull of
Long-billed Cockatoo

END OF PAPER