



HIGHER SCHOOL CERTIFICATE EXAMINATION

1997
BIOLOGY
2 UNIT

*Time allowed—Three hours
(Plus 5 minutes reading time)*

DIRECTIONS TO CANDIDATES

- Board-approved calculators may be used.

Section I—Core

- Attempt ALL questions.
- **Part A** 15 multiple-choice questions, each worth 1 mark.
Mark your answers in pencil on the Answer Sheet provided.
- **Part B** 10 questions, each worth 3 marks.
Answer this Part in the Part B Answer Book.
- **Part C** 6 questions, each worth 5 marks.
Answer this Part in the Part C Answer Book.
- Write your Student Number and Centre Number on each Answer Book.
- You may keep this Question Book. Anything written in the Question Book will NOT be marked.
- All drawings should be done in 'HB' pencil.

Section II—Electives

- Attempt ONE question.
- Each question is worth 25 marks.
- Answer the question in a *separate* Elective Answer Book.
- Write your Student Number and Centre Number on the cover of each Elective Answer Book.
- Write the Course, Elective Name, and Question Number on the cover of each Elective Answer Book.
- You may ask for extra Elective Answer Books if you need them.
- All drawings should be done in 'HB' pencil.

SECTION I—CORE

(75 Marks)

Attempt ALL questions.

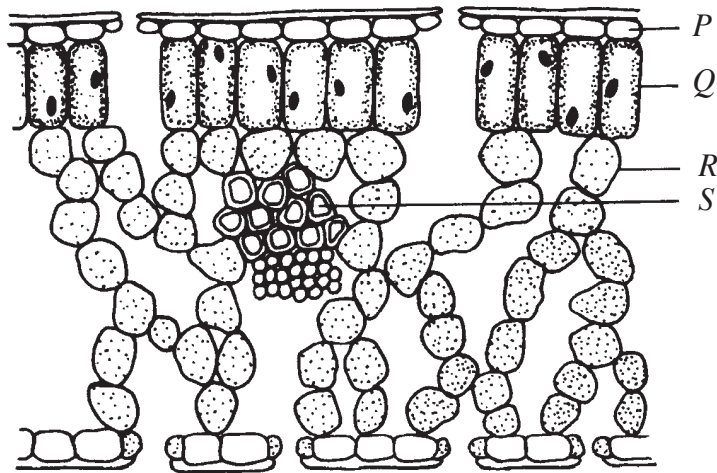
PART A

Questions 1–15 are worth 1 mark each.

Mark your answers in pencil on the Answer Sheet provided.

Select the alternative A, B, C, or D that best answers the question.

1. The diagram below is a vertical section through a leaf of a terrestrial flowering plant.



'Biology Study Guide', edn 1, Shirley Fung, Longman Cheshire 1993, p15.
Courtesy Addison Wesley Longman, www.awl.com.au

In this leaf most photosynthetic activity takes place in the tissue labelled

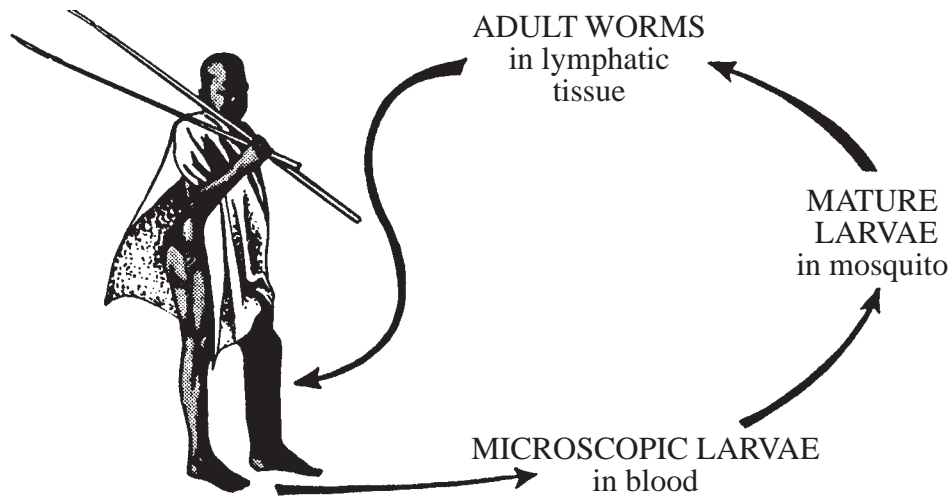
- (A) *P*
- (B) *Q*
- (C) *R*
- (D) *S*

2. An organism has a genotype represented by Gg Tt. This organism can produce different types of gametes. The possible gametes would be represented by
- (A) G, g, T, t
 - (B) Gg, gT, GT, gt
 - (C) GG, gg, TT, tt
 - (D) GT, Gt, gT, gt
3. Antigens are
- (A) chemicals released during the immune response.
 - (B) organisms that cause disease.
 - (C) chemicals that are used to fight infection.
 - (D) foreign chemicals that cause antibodies to be made in the body.
4. The leaves of some plants lose turgidity in hot dry weather. This happens because
- (A) the rate of respiration is greater than the rate of photosynthesis.
 - (B) the rate of photosynthesis is greater than the rate of respiration.
 - (C) water is lost through the stomates faster than it is absorbed by the roots.
 - (D) this response is a behavioural adaptation to ambient temperature variations.
5. Certain chemicals such as cytochrome C are found within the cells of all living organisms. The biochemical structure of cytochrome C in humans and chimpanzees is very similar. This suggests that
- (A) humans and chimpanzees belong to the same species.
 - (B) humans and chimpanzees had a common ancestor.
 - (C) humans evolved from chimpanzees.
 - (D) humans and chimpanzees evolved at the same time.
6. After coming in contact with an infectious micro-organism, your chances of then becoming infected would be increased if you
- (A) had a malfunction of the immune system.
 - (B) were immunised against a similar infection.
 - (C) had recently recovered from the same infection.
 - (D) had recently recovered from a similar infection.

7. Pathogens are

- (A) specialised types of B cell.
- (B) toxic chemicals in the environment.
- (C) always unicellular organisms.
- (D) organisms that cause diseases.

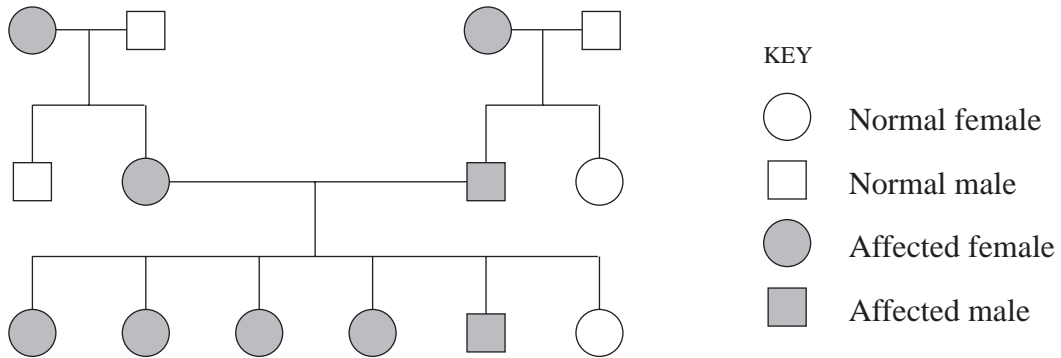
8. Elephantiasis is a disease caused by a parasitic nematode (roundworm). Adult worms invade lymphatic tissue throughout the body causing swelling of the limbs. The diagram below shows the life cycle of the nematode.



The most effective method of control for this disease is

- (A) frequent doses of antibiotics.
- (B) the draining of swamps where the mosquitoes breed.
- (C) amputation of infected parts.
- (D) isolation of infected persons.

9. The following pedigree is for a trait in a population.



For the allele responsible for the affected trait, which of the following patterns of inheritance is consistent with this pedigree?

- (A) Recessive but not sex-linked.
 - (B) Dominant but not sex-linked.
 - (C) Sex-linked recessive.
 - (D) Sex-linked dominant.
10. Random segregation is one of the most important events in meiosis because
- (A) it produces new combinations of the genetic information in gametes.
 - (B) it limits variation in genetic information.
 - (C) it halves the number of chromosomes in each cell during segregation.
 - (D) it produces new combinations of genes on chromosomes.
11. The body temperature of a snake can vary by several degrees during the day. This suggests that snakes
- (A) are ectotherms.
 - (B) have no structural adaptations to ambient temperature variation.
 - (C) are poorly adapted to their environment.
 - (D) have difficulty regulating their water balance.
12. Disease is defined as a condition which
- (A) is caused by a micro-organism or a parasite.
 - (B) interferes with the immune system.
 - (C) interferes with the body's normal function.
 - (D) is caused by poisonous substances.

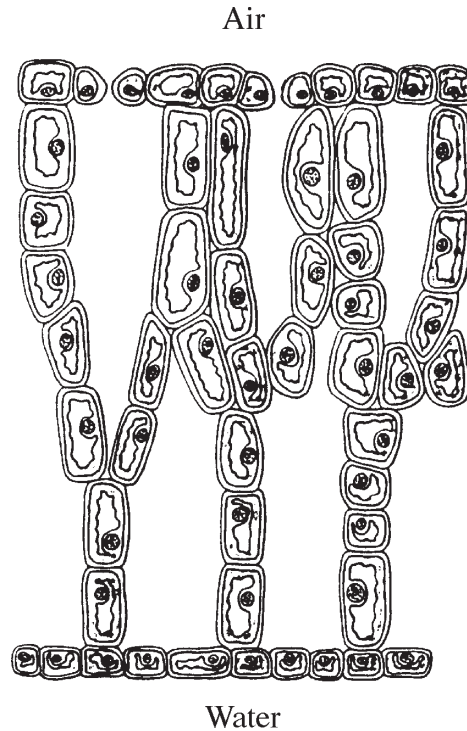
- 13.** Which of the following statements is true for Lamarck's theory of evolution?
- (A) Lamarck's theory includes the concept of the inheritance of acquired characteristics.
 - (B) Lamarck's theory does not allow for adaptation to a changing environment.
 - (C) Lamarck's theory presumes that individuals within a population are all identical.
 - (D) Lamarck's theory is based on the study of terrestrial mammals.
- 14.** Frogs spend part of their time in water and part on land. When moving from water to land, which of the following would a frog experience?
- (A) An increase in buoyancy and a decrease in viscosity.
 - (B) An increase in temperature variation and a decrease in light intensity.
 - (C) An increase in light intensity and a decrease in pressure.
 - (D) An increase in viscosity and a decrease in temperature variation.
- 15.** Red algae can be found at greater depths in the ocean than green algae. The reason for this is
- (A) red algae must be attached to the ocean floor.
 - (B) the temperature range at shallow depths is too great for red algae to survive.
 - (C) red algae use the available light energy more efficiently than green algae at these depths.
 - (D) green algae have structures to increase their buoyancy.

PART B

Questions 16–25 are worth 3 marks each.

Answer this Part in the Part B Answer Book.

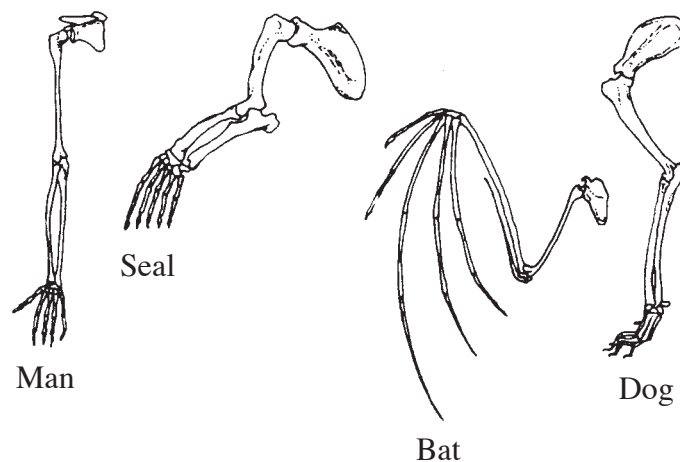
- 16.** The diagram below shows a section through the leaf of a freshwater aquatic plant whose leaves float on the surface of the water.



'Biological Science', 3rd ed, Keeton,
WW Norton & Co 1980, fig 6.6, p242

- (a) Describe one advantage for this plant in having its leaves in contact with air.
 - (b) Describe one advantage for this plant in having its leaves in contact with water.
 - (c) Explain how the leaves of this plant are able to float, even though plant tissues are denser than water.
- 17.** Sometimes the body's immune system does not function properly, due to an auto-immune disease or an immune-deficiency disease.
- (a) Name ONE example of a malfunction in the immune system.
 - (b) How does this disease affect the immune system?
 - (c) Name TWO characteristic symptoms of this disease.

- 18.** Albinism (lack of skin pigmentation) in humans is caused by two recessive alleles. A phenotypically normal (non-albino) couple have three children; the first two are non-albino, the third is an albino. In your answer, use 'A' for the dominant allele and 'a' for the recessive allele.
- What are the genotypes of the parents?
 - Is there a possibility that their next child will be an albino? Explain your answer. Show all working.
 - The albino child eventually marries a non-albino whose father was an albino. What is the probability that their first child will be an albino? Explain your answer. Show all working.
- 19.** A biologist took a scraping of a diseased patch on the leaf of a plant. He cultured the scraping and found that a pure culture of bacteria developed. The bacterial growth in the culture dish may be responsible for the disease on the plant leaf. What steps would Koch have followed to determine this?
- 20.** Shown below are four homologous structures. How can they be used as evidence for the theory of evolution?

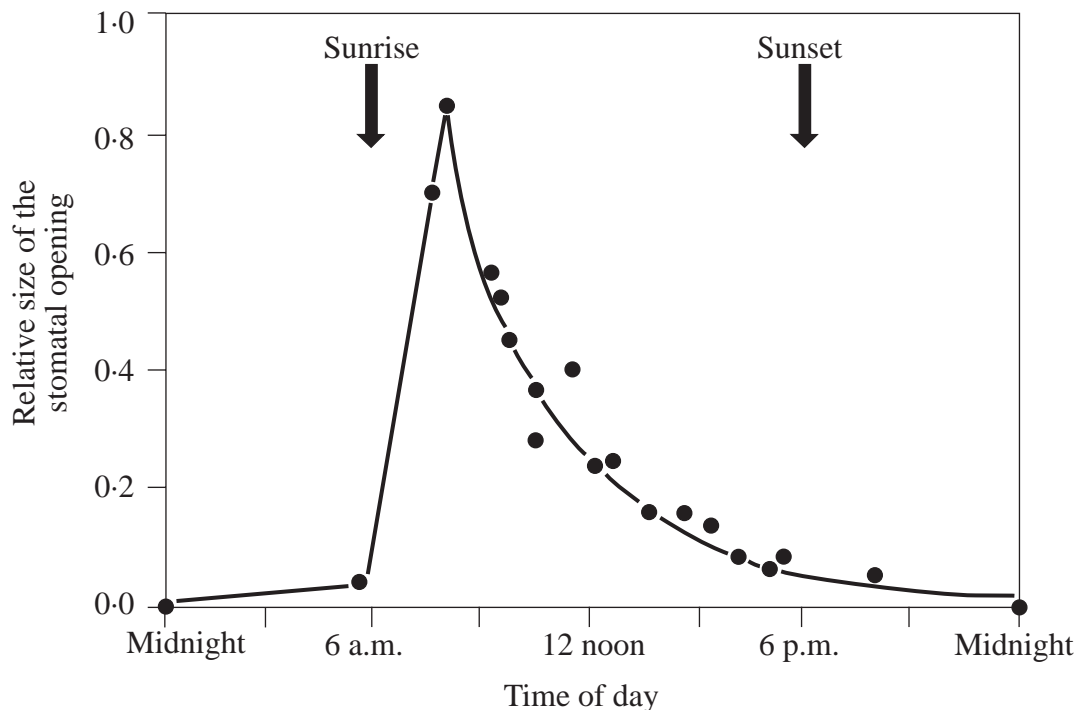


FORELIMBS OF FOUR DIFFERENT MAMMALS

'Biology data and resource book', Hawes et al, Longman Cheshire 1983, p61.

- 21.** In pea plants, the characteristic of height is controlled by a dominant/recessive inheritance pattern. 'T' represents the dominant allele for tall plants, and 't' represents the recessive allele for short plants.
- Two plants are crossed that are both heterozygous for height.
- What ratio of phenotypes would you expect in their offspring?
 - The actual ratio of phenotypes of their offspring was 2 tall : 1 short. Explain ONE possible environmental reason for the difference between the expected and actual ratios.

22. Multidrug-resistant *Staphylococcus aureus* (MRSA) is a bacterium that has developed resistance to nearly every modern antibiotic. Explain how bacteria such as MRSA can develop, in terms of modern evolutionary theory.
23. During your study of human disease you examined statistical data on the incidence of a disease.
- Name the disease you studied.
 - What TWO conclusions could you make about the incidence of the disease, based on the statistical data?
 - Explain how statistical data of this kind could be used to help reduce the incidence of this disease.
24. The graph below shows the changes in the relative size of the stomatal openings in the leaves of a eucalypt tree during a 24-hour period. This is an example of a physiological adaptation.



- Describe what changes occur to the stomates during this period.
 - What is the significance of this adaptation for the plant's survival?
 - The same eucalypt tree experiences a period of heavy rain. Would you expect the relative size of the stomatal opening at 12 noon to be the same as indicated on the graph? Explain your answer.
25. Evidence suggests that animals evolved in water and diversified to form all the major animal phyla before terrestrial life forms evolved.

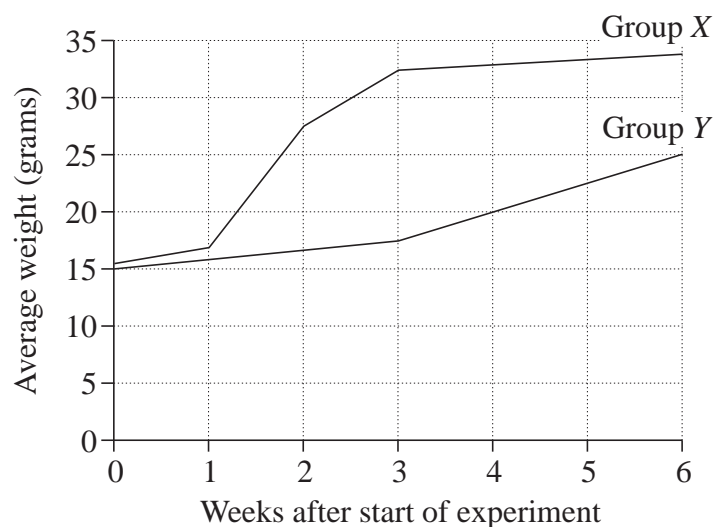
Describe THREE structural or physiological changes that had to occur for animals to survive in a terrestrial environment. For each of these changes, explain why it was necessary.

PART C

Questions 26–31 are worth 5 marks each.

Answer this Part in the Part C Answer Book.

- 26.** In an experiment to investigate the effects of food additives on growth rates in animals, fifty young mice were divided randomly into two groups of twenty-five. Mice in group X were fed a diet containing a food additive, and mice in group Y received the same food but without the additive. Each mouse was weighed regularly and the average weights of mice in each group over a six-week period are shown in the graph below.



- When is there the greatest difference between the average weights of mice in groups X and Y?
 - Describe the pattern of growth in group X during the experiment.
 - Why is it necessary to include group Y in this experiment?
 - Suggest ONE hypothesis to explain the growth pattern described in part (b).
 - Briefly describe an experiment to test your hypothesis.
- 27.** Animals and plants living in hot desert environments need to conserve scarce water and at the same time prevent overheating.
- Explain how some animals living in a desert environment may maintain their body core temperature lower than their surroundings by:
 - behavioural adaptation;
 - structural adaptation;
 - physiological adaptation.
 - The control of water loss in plants is usually by means of structural adaptations. Detail how TWO of these structural adaptations reduce water loss in desert plants.

- 28.** A mutation giving white eye colour in fruit flies is sex-linked. The normal red-eye allele (R) is dominant to the white-eye allele (r). A white-eyed female (X_rX_r) is crossed with a red-eyed male (X_RY).
- (a) Write down the genotypes of males and females in the first generation of offspring.
 - (b) These offspring are allowed to mate among themselves. What percentage of males produced in the next generation will have red eyes? Show all working.
 - (c) A red-eyed female fly was trapped in the wild. How could a scientist determine whether this fly was homozygous or heterozygous for red eyes? Show all working.
- 29.** White blood cells play a vital role in the body's defence against disease.
- (a) Name THREE different types of white blood cells you have studied. For each, describe its role in the immune response.
 - (b) Describe the roles of white cells in the immunisation process.
- 30.** Some aquatic mammals are capable of diving to great depths in the ocean in search of food.
- (a) Describe TWO changes in the environment that a mammal would experience as it dived from the surface to the ocean floor.
 - (b) The Weddell seal is an aquatic mammal with a large spleen that stores 60% of its oxygenated red blood cells. During dives, the red blood cells are released into the bloodstream. What is ONE advantage of adding oxygenated red blood cells to the bloodstream during dives?
 - (c) At the start of a dive, blood flow in Weddell seals is reduced to most parts of their body, including their muscles, but not their brain and spinal cord.
 - (i) During long dives, what advantage is there in reducing blood flow to the muscles?
 - (ii) Why must blood flow to the brain and spinal cord be maintained at normal levels?
 - (d) Before they dive, Weddell seals exhale to remove air from their lungs. Suggest ONE reason for this behaviour.

- 31.** (a) Define the term *non-infectious disease*.
- (b) In your course, you have studied two non-infectious diseases. For BOTH diseases, complete the table provided in the Answer Book for each of the following.
- Name of the disease
 - Cause of the disease
 - Typical symptoms of the disease
 - Methods for controlling the disease

SECTION II—ELECTIVES

(25 Marks)

Attempt ONE question.

Answer the question in a *separate* Elective Answer Book.

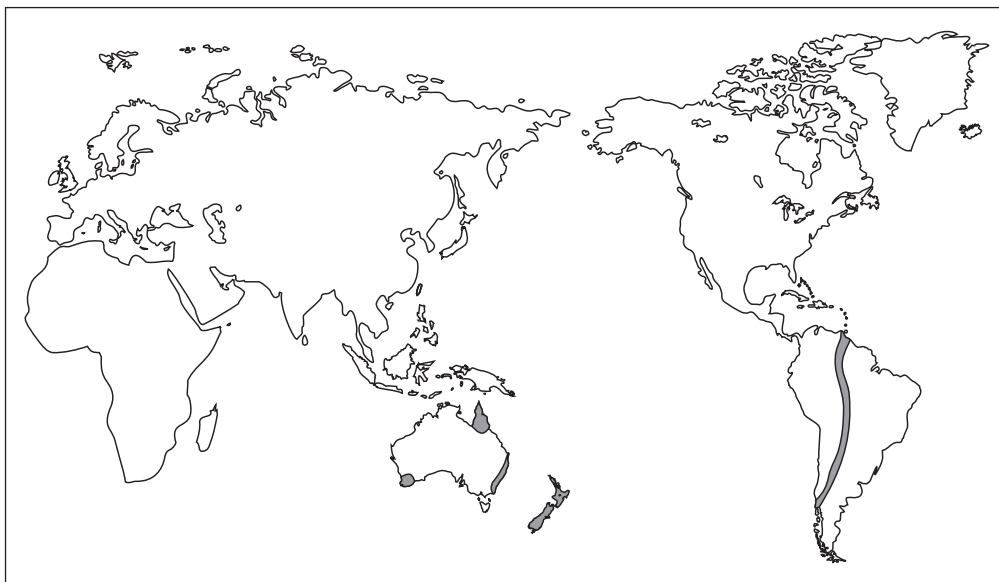
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QUESTION 32. The Australian Environment**Marks**

- (a) (i) Name TWO Australian marsupials you have studied, and describe the present distribution of each. **5**
- (ii) Discuss how the similarities and/or differences in these distributions are related to each of the following factors.
1. Climate
 2. Topography
 3. Human activities

Maps, tables, or diagrams may be used where necessary.

- (b) The diagram below represents the worldwide distribution of mistletoes of the Family Loranthaceae. They are native rainforest plants. **3**



KEY

■ Distribution of Loranthaceae

- (i) This family of mistletoes does not occur naturally in the Northern Hemisphere but is found on Southern Hemisphere continents separated by large oceans. Use the theory of continental drift to explain this distribution.
- (ii) The Australian continent has experienced climatic change over millions of years. How may the theory of continental drift be used to account for these changes?
- (iii) What effects have the climatic changes during the last 50 million years had on the evolution of Australian flora and fauna?

QUESTION 32. (Continued)

Marks

- (c) There are many introduced species of plants and animals in Australia. 5
- (i) Name ONE introduced plant and ONE introduced animal that have had a marked impact on the Australian environment.
 - (ii) For EACH of the above species, describe a change that would occur to the Australian environment if the species were removed. Give a reason for each change.
 - (iii) Choose ONE of the above species. Why has it been so successful in populating the Australian environment? Give TWO reasons.
- (d) 9
- (i) Name the ecosystem you have studied.
 - (ii) If you wished to determine the effect of environmental disturbance on this ecosystem, you could study a number of abiotic components. Name ONE physical and ONE chemical component of your ecosystem that could be affected by environmental disturbance. Discuss the reason for your choice in each case.
 - (iii) Detail the life cycle of ONE named animal you found in this ecosystem.
 - (iv) Describe how the animal named in (d) (iii) influences the dynamics of the system.
 - (v) Use a food-web diagram to demonstrate the flow of energy through the system, naming at least FIVE organisms involved in the process. Include at least TWO indigenous and TWO introduced organisms.
 - (vi) List two indigenous organisms in your diagram above.
- (e) To determine the distribution and/or abundance of plant and animal species in the ecosystem, the following techniques could be used. 3
- Transects
 - Quadrats
 - Capture–recapture
- (i) For EACH of the above techniques, name a plant or animal whose distribution and/or abundance could be measured.
 - (ii) Explain why this particular technique is the most appropriate for EACH species named in part (e) (i).
 - (iii) Clearly state what is measured by EACH technique.

QUESTION 33. Structure and Function of Cells and Tissues**Marks**

- (a) Draw a diagram of a chloroplast, showing its internal structure. **2**

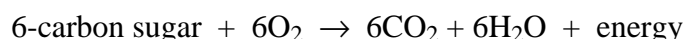
On your diagram, label:

- (i) the site of the light reaction, with the letter *A*.
- (ii) the site of carbon dioxide fixation, with the letter *B*.

- (b) Glucose and oxygen gas are produced as a result of photosynthesis. **2**

- (i) Where do the oxygen atoms in glucose come from?
- (ii) Where do the atoms in oxygen gas come from?

- (c) The overall equation for the process of aerobic respiration is shown below. **6**



This summary equation disguises the fact that the process of aerobic respiration consists of a series of stages that occur one after the other.

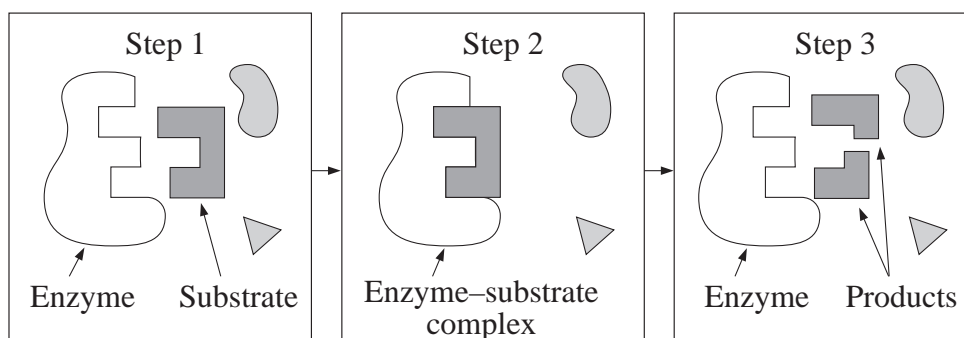
- (i) Name the most common 6-carbon sugar broken down in respiration.
- (ii) The first stage in the breakdown of sugars is called glycolysis. Where in the cell does glycolysis occur?
- (iii) During which stage of respiration is most of the carbon dioxide produced? Where in the mitochondrion does this stage of respiration take place?
- (iv) Name the molecule represented by the term 'energy' in the above equation. During which stage of respiration is most of this substance produced?
- (v) During which stage of respiration is most of the hydrogen attached to carrier molecules?
- (vi) After glycolysis, some cells follow an anaerobic pathway. What is the difference in the amount of energy produced in aerobic and anaerobic pathways?

QUESTION 33. (Continued)

Marks

(d) The diagram below represents a chemical reaction catalysed by an enzyme.

5



- How does this model explain the idea of enzyme specificity?
 - Some drugs are effective in killing parasites because they block enzymes involved in biochemical pathways critical for the growth of the organism. Using a diagram similar to that above, illustrate how these drug molecules could block the enzyme involved.
 - The enzyme amylase, which is found in saliva, promotes the breakdown of starch to maltose. If saliva is mixed with starch, eventually all the starch will be broken down, regardless of the amount of saliva added. Explain why this occurs.
 - Food containing starch is mixed with saliva in the mouth and the starch begins to break down due to the action of amylase. Suggest what may happen to the rate of this reaction when the food enters the stomach.
- (e) Draw a diagram of a plant root tip in longitudinal section.

4

Select THREE distinct regions and mark them A, B, and C. Describe the function of:

- region A;
- region B;
- region C.

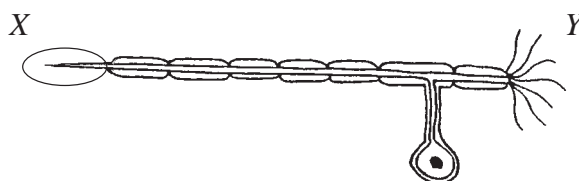
QUESTION 33. (Continued)

Marks

- (f) (i) If you were examining a selection of plant and animal cells from multicellular organisms, using a light microscope, how would you determine if they were plant or animal cells? **6**
- (ii) Name ONE animal tissue you have studied.
1. What characteristic features would you use to distinguish this tissue from other animal tissues?
 2. Explain the function of one of the features you described in part (ii) 1.
- (iii) Draw and *fully label* a named unicellular organism you have studied. For this organism, explain how:
1. it obtains food;
 2. it moves.

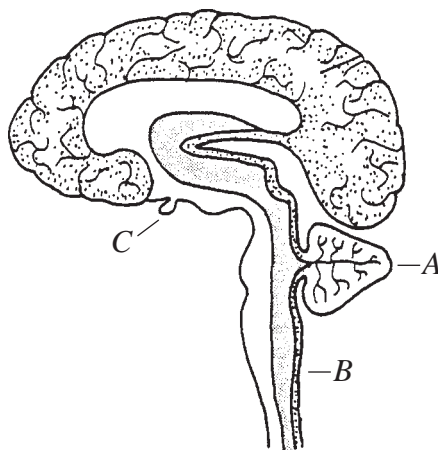
QUESTION 34. Control and Coordination**Marks**

- (a) The diagram below shows a neurone found in the body.

3

- (i) What type of neurone is this?
- (ii) Where in the body would part *Y* be located?
- (iii) Is the impulse travelling towards *X* or *Y*?

- (b)

3

- (i) Name the structures labelled *A*, *B*, and *C* on the diagram.
- (ii) Give ONE function for each of the structures *A* and *B*.
- (iii) What role does *C* play in the maintenance of homeostasis?

- (c) Homeostasis in mammals is controlled by feedback systems.

4

For a feedback system involving hormones:

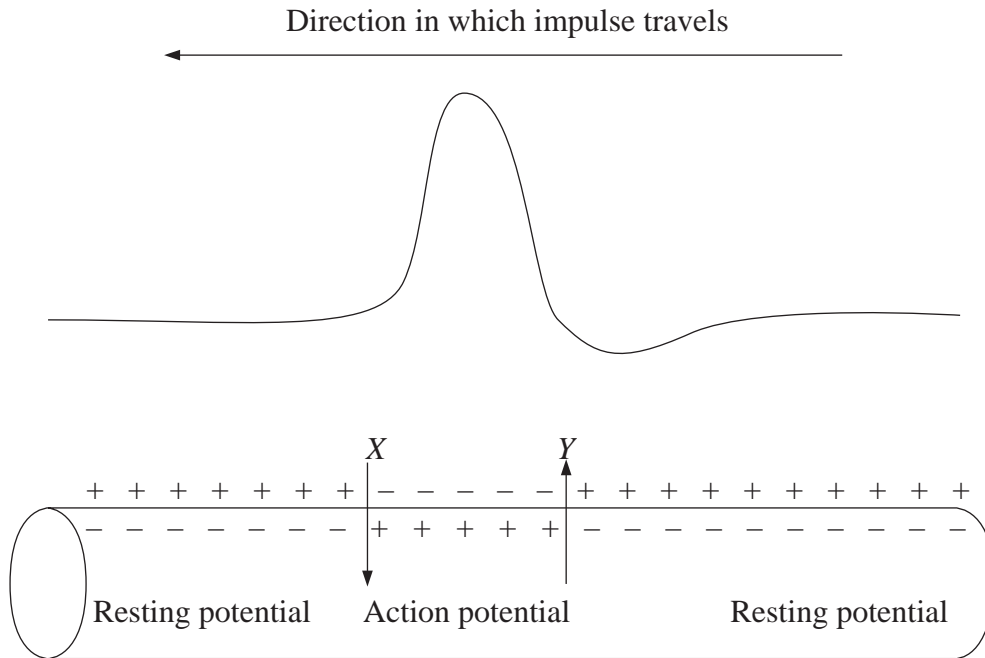
- (i) name the main hormone involved;
- (ii) name a target organ for this hormone;
- (iii) describe the response of the target organ to this hormone;
- (iv) explain why this hormone regulates the function of this specific target organ and not other organs;
- (v) explain how feedback controls the release of this hormone.

QUESTION 34. (Continued)

Marks

- (d) The diagram below shows a nerve impulse travelling along an axon.

4



- (i) During propagation of the nerve impulse, which ions:
 1. enter the nerve cell at *X*?
 2. leave the nerve cell at *Y*?
 - (ii) How do nerve impulses carry information concerning differing stimulus strengths?
 - (iii)
 1. Define the term *neurotransmitter*.
 2. How is a neurotransmitter involved in the function of the nervous system?
- (e) Coordination in animals is controlled by the interaction between the endocrine and nervous systems.
- (i) The nervous system produces responses in less than a second, while responses in the endocrine system are much slower. Explain this difference.
 - (ii) Describe in detail ONE example of a response that involves both the nervous and endocrine systems. Explain how each system contributes to the response.

4

QUESTION 34. (Continued)

Marks

- | | | | |
|-----|-------|--|----------|
| (f) | (i) | What is phototropism? | 4 |
| | (ii) | Name a plant hormone that is involved in phototropism, and describe how it acts. | |
| | (iii) | Describe an historical experiment that has increased our understanding of the nature of phototropism. Diagrams may be used in your answer. | |
| (g) | (i) | Plant growth is a complex process involving the action of many hormones. Name ONE of these hormones, and describe its role in plant growth. | 3 |
| | (ii) | Seasonal events that occur in plants, such as fruiting, flowering and leaf fall, were thought to be related to changes in temperature. We now know that this is not the only stimulus involved. What other environmental factor is a stimulus for these plant responses? | |

QUESTION 35. Classification and the Species Concept**Marks**

- (a) Genetic change plays a major role in the process of speciation. While genetic change is usually a gradual process, this is not always the case. **2**

Using a suitable example, explain how genetic change could produce new species within a few generations.

- (b) (i) Name a species of plant you have studied for this elective, and name the family to which it belongs. **5**
- (ii) Describe TWO features of the species named in part (b) (i) that are shared with other members of this family.
- (iii) Name another species in this family. Describe TWO features that distinguish these two species from each other.
- (iv) If you found another plant that had some characteristics of the species you named in part (b) (i), how could you determine whether this plant belongs to the same species?

- (c) Human activities are influencing the course of evolution by creating new mechanisms of isolation. **3**

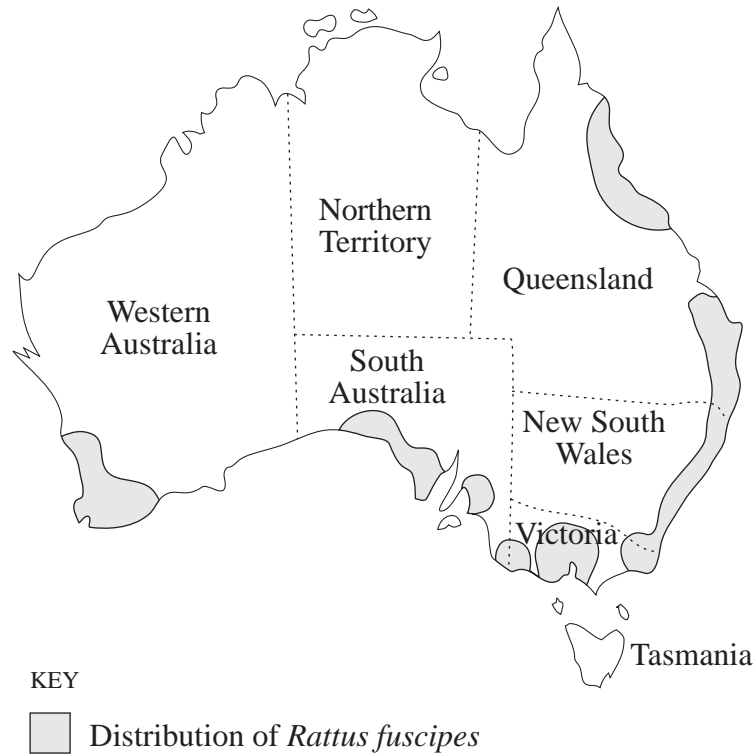
Explain how the building of a dam on a river could cause a species of fish to evolve into two separate species.

- (d) (i) Name an insect you have studied for this elective. **5**
- (ii) Name the phylum to which this insect belongs, and describe TWO features of the insect that demonstrate that it belongs to this phylum.
- (iii) Name the order to which this insect belongs, and describe TWO features of the insect that demonstrate that it belongs to this order.

QUESTION 35. (Continued)

Marks

- (e) The bush rat (*Rattus fuscipes*) is a widespread and common species of native rat living in coastal bushland. Gaps in its distribution are shown in the map below. Within this species there are regional differences in some physical characteristics. For example, adult bush rats from New South Wales are on average about 30% larger than bush rats from Western Australia. 6



- (i) How could you determine if the bush rat populations form a cline?
- (ii) The size difference between eastern and western populations of bush rat may be the result of genetic variability. Describe the role of genetic variability in the process of speciation.
- (iii) Suppose a scientist transferred bush rats from New South Wales to Western Australia and released them into a fenced area of coastal bushland that had bush rats already present. If these groups were unable to interbreed and produce offspring, would you conclude that the two populations were in fact separate species? Explain your answer.
- (iv) The bush rat is often mistaken for the heath rat (*Pseudomys shortridgei*), a rare native species, and is also very similar in appearance to the black rat (*Rattus rattus*), an introduced species that lives in towns and cities. Which of these two rats is more closely related to the bush rat? Explain your answer.

QUESTION 35. (Continued)

Marks

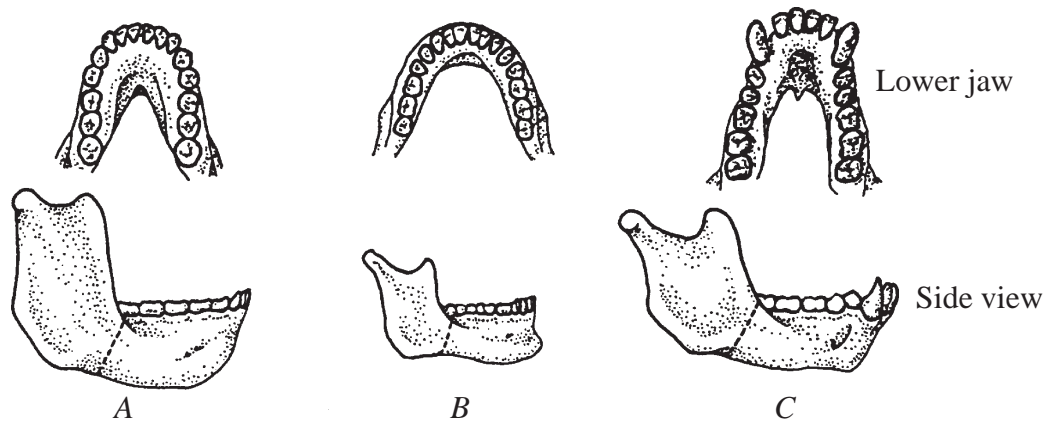
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|-----|-------|--|----------|
| (f) | (i) | Classification of organisms is a difficult process requiring a lot of time and energy. Explain why biologists bother with classification. | 4 |
| | (ii) | In this elective, you studied a hierarchical classification system. Explain what this means by referring to the classification system you have studied. | |
| | (iii) | Structural characteristics are generally used as a basis for classification. Explain why structural characteristics are preferred over other features such as behaviour or distribution. | |

QUESTION 36. The Human Species**Marks**

- (a) A small insect-eating mammal is thought by some biologists to be a primitive primate. **3**

Describe THREE structural features you would look for that would be evidence that this mammal may be a primate.

- (b) The diagram below shows the fossilised lower jaws of three primates. **3**



- (i) Which jaw belongs to the most advanced primate?
- (ii) Give TWO reasons for your answer.
- (c) *Homo sapiens* is classified by a combination of characteristics that distinguish this species from all other primates. **3**

Describe THREE of these characteristics.

- (d) Cultural evolution involves the transfer of information from generation to generation in a non-genetic way. In the last 40 000 years there have been significant changes in our culture. **4**

Discuss TWO examples of these changes, and describe the significance of each for human societies.

- (e) Ancient cultures, such as that of the Australian Aborigine, are studied using palaeontological and archaeological evidence. However, other aspects of culture may also be required, to give a more complete picture. **4**
- (i) Give ONE example of palaeontological evidence, and ONE example of archaeological evidence, that help us understand the past cultures of the Australian Aborigine.
- (ii) What other types of evidence can also be used to help us to interpret the history of the Australian Aborigine?

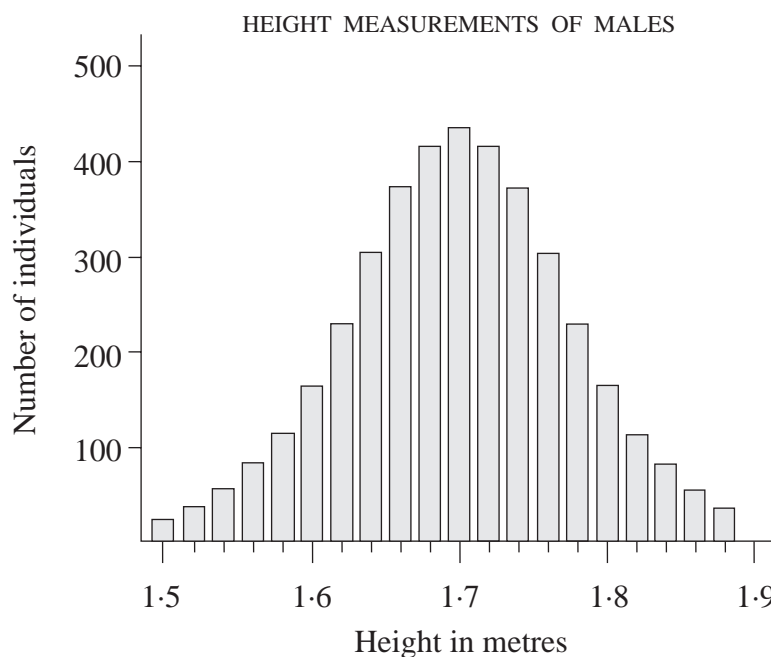
QUESTION 36. (Continued)

Marks

- (f) Many species may be described as polymorphic. The literal meaning of the term 'polymorphic' is 'many forms'. 3
- (i) Explain why *Homo sapiens* is considered a polymorphic species.
 - (ii) Give ONE characteristic of *Homo sapiens* that shows a clinal gradation between different populations.
 - (iii) Why does this clinal gradation exist? Give ONE reason.
- (g) The frequency of certain alleles in the human population is higher in some races than in others. This suggests that these alleles may give an adaptive advantage to individuals who have them. 3
- Name TWO examples of inherited traits in humans that are found more frequently in one race than in others. Discuss why EACH is an advantage to that race.
- (h) Humans have the potential to influence their own evolution. How does each of the following contribute to human evolution? 2
- (i) Agriculture
 - (ii) Genetic techniques

QUESTION 37. Genes in Action**Marks**

- (a) (i) Name a genetic disorder you studied that is caused by a base substitution mutation. **4**
- (ii) Explain why a base substitution mutation generally has less serious consequences than a frameshift mutation.
- (iii) Why is it that the great majority of mutations have no effect on gene expression?
- (iv) Name ONE chemical substance, and ONE form of radiation, that are known to promote gene mutation.
- (b) Some mutations are due to chromosome number changes. **2**
- (i) Describe ONE way that such changes in number might occur.
- (ii) What possible effect could a change in chromosome number have on a sexually reproducing organism?
- (c) The following frequency histogram illustrates the number of individuals in different height classes from a sample of males in NSW. **3**



- (i) What type of inheritance pattern determines human height?
- (ii) Explain how this form of inheritance can produce such a range of heights in the population.

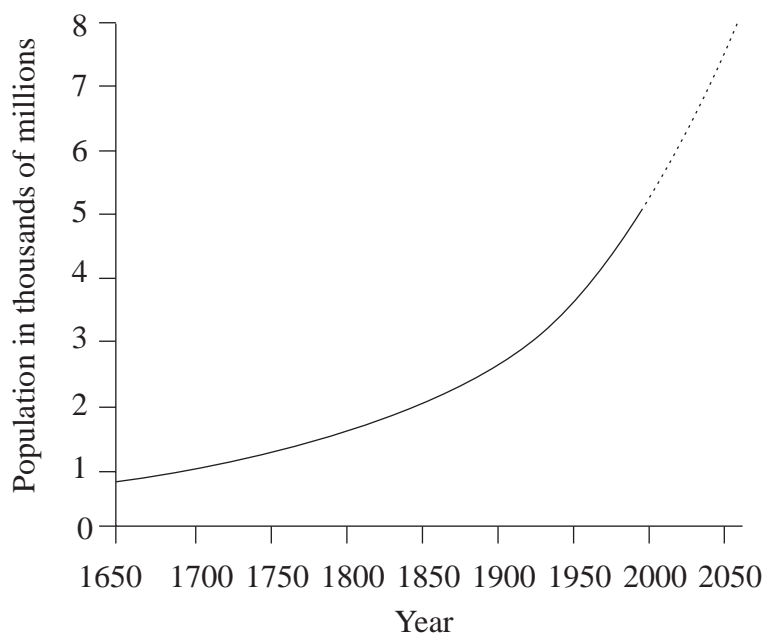
QUESTION 37. (Continued)

Marks

- (d) (i) Explain what is meant by the term 'linkage'. 3
- (ii) For a single chromosome, the percentage recombination between genes *N* and *T* is 12%, between genes *N* and *R* is 9%, between genes *T* and *Q* is 6%, and between genes *Q* and *R* is 15%. What is the order of these genes on the chromosome?
- (e) (i) In terms of dominance, codominance, and recessiveness, what relationships exist between alleles in the ABO blood group system? 3
- (ii) A woman having blood type A had a type O and a type B child. What is the genotype and phenotype of the father? Show all working.
- (f) (i) Genetic manipulation of plants and animals has been used extensively in agriculture. Give an example of how ONE plant and ONE animal has been altered by this method to benefit humans. 4
- (ii) Genetic counselling is available for couples who believe they may be at risk of producing a child with a genetic disorder. In practical terms, how might such counselling be of benefit?
- (iii) Cloning is an experimental process that enables scientists to produce animals with identical genetic make-up. Recent research has shown that it is possible to clone mammals. What dangers and ethical problems could such genetic manipulation present in the future?
- (g) (i) Analysis of a double-stranded DNA sample yielded 15% cytosine. 3
- What would be the percentage of the other bases in this sample?
- (ii) Describe TWO differences between the structures of DNA and RNA.
- (iii) Write out the DNA codon that corresponds to the anticodon UUU.
- (h) (i) Name TWO types of RNA molecules. 3
- (ii) Explain in detail how each is related to the process of protein synthesis.

QUESTION 38. Human Environmental Impact**Marks**

- (a) Below is a graph of world human population growth.

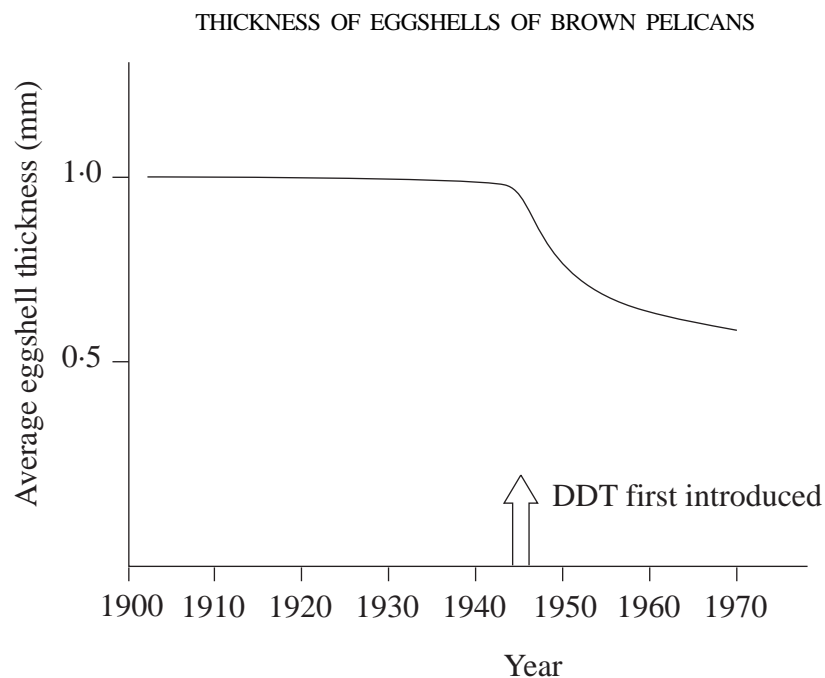
2

- (i) List TWO changes in human activity that have led to this dramatic increase in human population over the last 350 years.
- (ii) How has EACH of these changes resulted in a population increase?
- (b) Name THREE agricultural practices that have had impacts on the Australian environment. Select ONE, and describe in detail what impact this activity has had on the environment. **3**
- (c) (i) What is meant by the term 'resource'? **3**
- (ii) How do resource exploitation and redistribution affect wild gene pools?
- (iii) Describe TWO environmental effects of resource stripping.
- (d) Urbanisation has resulted in increased pollution of our environment. **3**
- (i) Name ONE pollutant that has resulted from increased urbanisation.
- (ii) Describe a method currently used to dispose of, or reduce levels of, this pollutant in our environment.
- (iii) Explain any effects this pollutant has on the environment.

QUESTION 38. (Continued)

Marks

- (e) (i) Why have some introduced species of animals and plants had such a dramatic effect on the Australian environment? **4**
- (ii) Name ONE introduced species, and describe a method that may be used to control its numbers.
- (iii) What factors have limited the distribution of this species?
- (f) Brown pelicans nesting on islands show the effects of the pesticide DDT in their bodies by laying thin-shelled eggs. **4**



- (i) Pelicans are fish-eating birds. Explain how DDT can accumulate in the bodies of these pelicans.
- (ii) What effect could laying thin-shelled eggs have on the pelican population?
- Explain your answer.
- (iii) These birds still have high levels of DDT in their bodies years after the use of DDT was banned. Give a reason for this.

QUESTION 38. (Continued)

Marks

- (g) Some of Sydney's waterways have recently been affected by algal blooms. These blooms are due to a large increase in the numbers of poisonous blue-green algae. These blooms can kill thousands of aquatic organisms and cause harm to humans. **3**
- (i) What types of substances can cause an increase in the number of blue-green algae?
 - (ii) How do these substances get into our waterways?
 - (iii) What can we as a community do to reduce the risk of blue-green algal blooms?
- (h) **3**
- (i) Give ONE example to describe the concept of sustainable agriculture.
 - (ii) Describe TWO ways that we can conserve energy in our environment.
 - (iii) Name an endangered species.
Give ONE reason why this species should be protected.

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