



HIGHER SCHOOL CERTIFICATE EXAMINATION

1998
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.
Complete your answers in blue or black pen, or 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 the cover of each Answer Book.
- You may keep this Question Book. Anything written in the Question Book will NOT be marked.

Section II—Electives

- Attempt ONE question.
- Each question is worth 25 marks.
- Answer each 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.

Complete your answers in blue or black pen, or in pencil on the Answer Sheet provided.

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

1. Most non-infectious diseases
 - (A) cannot be transmitted from one person to another.
 - (B) are caused by vectors such as mosquitoes or ticks.
 - (C) are caused by parasites.
 - (D) can be successfully treated with modern antibiotics.

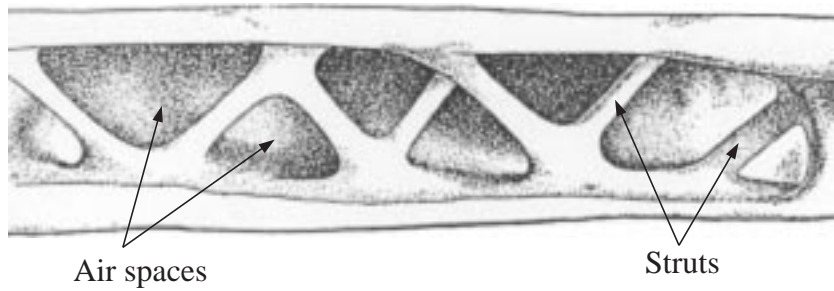
2. Pyrethroids are chemicals used to kill insects. Within a few years of the introduction of pyrethroids, some populations of insects have become resistant to these chemicals. This is an example of
 - (A) how evolution results from slow changes in a population.
 - (B) changes in organisms to cope with their new surroundings.
 - (C) a new selecting agent acting on a population.
 - (D) a new agent causing adaptation in organisms.

3. Vaccines can provide immunity to disease by
 - (A) causing the body to produce antibodies.
 - (B) preventing entry into the body by pathogens.
 - (C) engulfing and destroying bacteria.
 - (D) producing antigens that kill bacteria.

4. The order of bases in a strand of DNA is ATGCGT. The complementary strand of DNA would be
- (A) ATGCGT.
 - (B) GCATAC.
 - (C) TACGCA.
 - (D) TGCGTA.
5. T-lymphocytes
- (A) work in conjunction with red blood cells to produce immunity.
 - (B) are white blood cells that form a barrier over open wounds by creating a scab.
 - (C) are activated by antibiotics.
 - (D) can recognise antigens.
6. Both parents are heterozygous carriers of a recessive gene 'a' so that their genotype is 'Aa'. The probability that their child will NOT inherit the gene 'a' is
- (A) $\frac{7}{8}$
 - (B) $\frac{3}{4}$
 - (C) $\frac{1}{2}$
 - (D) $\frac{1}{4}$
7. Darwin and Lamarck both formulated theories of evolution. Which statement represents ONLY Lamarck's theory?
- (A) Individuals with characteristics that help them in their struggle for existence have the best chance to survive.
 - (B) Changes in an individual produced by the environment during its lifetime are passed onto its offspring.
 - (C) Successive generations become progressively better suited to their environment.
 - (D) Individuals of the same species differ slightly from one another.

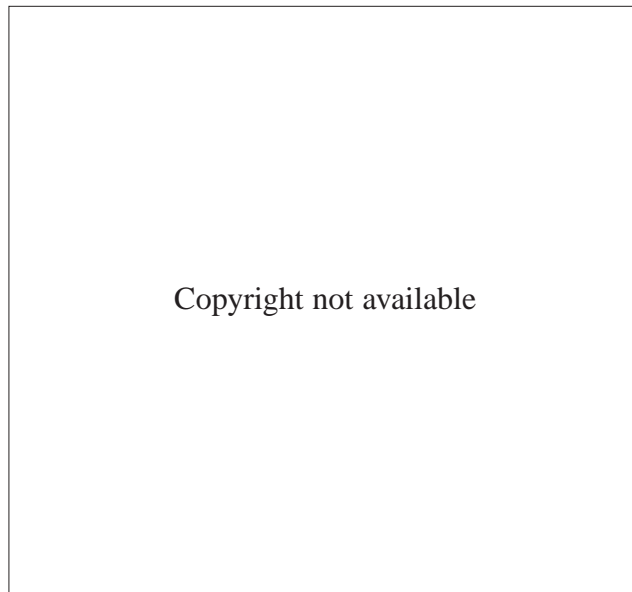
8. If a chemical were developed that caused the stomates of land plants to stay open at all times, what would be the main effect of this on the plant?
- (A) Most of the plant cells would lose turgor.
 - (B) The vacuoles in the plant cells would burst.
 - (C) The xylem vessels in the plant would burst.
 - (D) The plant would take up water from the soil at a decreased rate.
9. Which of the following is the most accurate statement with regard to temperature regulation in animals?
- (A) All aquatic animals are endothermic.
 - (B) The body temperature of ectotherms is always the same as the temperature of their environment.
 - (C) Cellular respiration in ectothermic animals does not produce any heat.
 - (D) The rate of cellular respiration in endotherms is affected by the temperature of the environment.
10. In the double helix model of DNA and DNA replication,
- (A) a chromosome is one of the single strands of DNA.
 - (B) each strand of DNA must contain an identical number of adenine bases.
 - (C) each new DNA double helix will contain one DNA strand from the original double helix after replication.
 - (D) the old DNA strands are completely broken down during replication.
11. Pathogens are
- (A) organisms that can only survive in the body of a host.
 - (B) cells that engulf foreign materials and break them down for elimination from the body.
 - (C) organisms that cause disease.
 - (D) fragments of cells with the specialised function of clotting.

12. The diagram below shows a longitudinal section through the long bone of a bird.



The main advantage of the many air spaces and struts is to

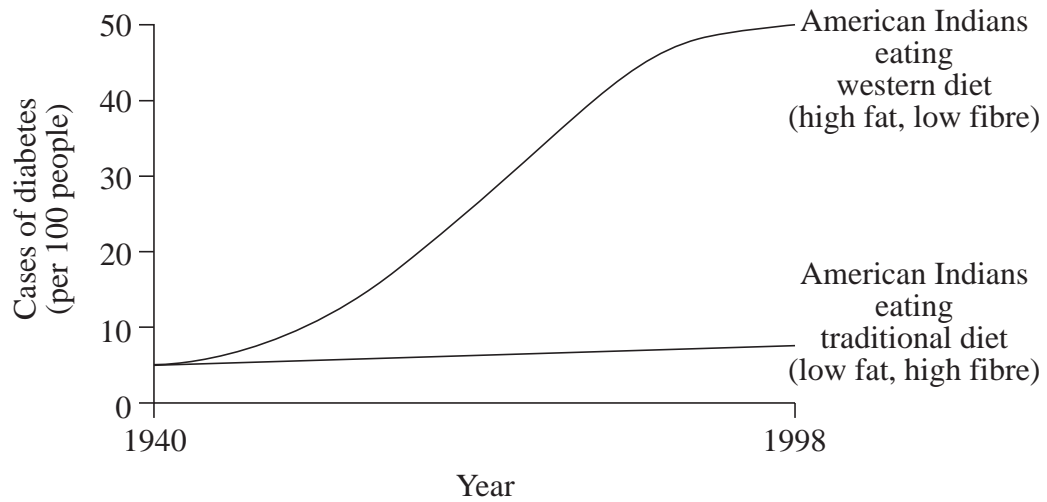
- (A) provide room for bone marrow and red blood cells.
 - (B) provide strength and lightness.
 - (C) increase oxygen uptake needed for flight.
 - (D) allow wastes to drain back to excretory organs.
13. Below is a diagram of a nudibranch (sea slug) showing its gill system.



The most likely reason for the large number of gill structures is to

- (A) increase the surface area for exchange of gases.
- (B) provide protection for the respiratory surfaces.
- (C) decrease the volume of blood required for the diffusion of gases.
- (D) decrease the absorption of pollutants from the environment.

14. Over the last 50–60 years some native American Indians have adopted a western diet. The graph below shows the estimated incidence of diabetes in two groups of American Indians.



The best conclusion that can be drawn from the graph above is that

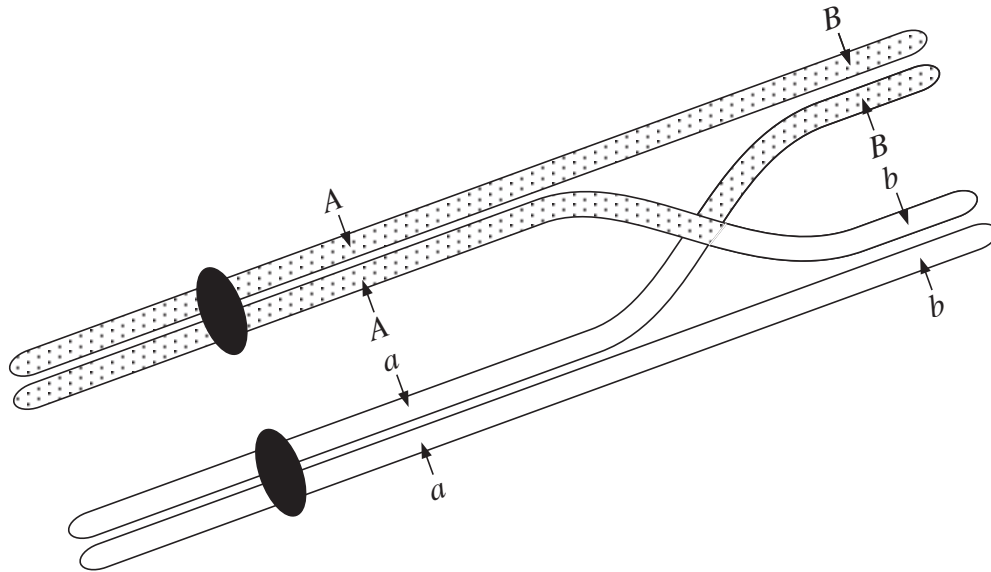
- (A) diabetes did not exist in these American Indians before 1940.
 - (B) not all American Indians who adopt a western diet will get diabetes.
 - (C) the genotype of American Indians has markedly changed after adopting a high fat, low fibre western diet.
 - (D) American Indians will not get diabetes if they stay on their low fat, high fibre traditional diet.
15. Most freshwater fish placed in sea water would die quickly because
- (A) sea water contains less oxygen than fresh water.
 - (B) carbon dioxide is not as easily excreted into salt water.
 - (C) ions will move out of the fish by osmosis.
 - (D) water will diffuse out of the fish into the sea water.

PART B

Questions 16–25 are worth 3 marks each.

Answer this Part in the Part B Answer Book.

16. The diagram below shows two homologous chromosomes during cell division. One of these homologous chromosomes carries dominant genes (A , B) and the other, recessive genes (a , b).



- (a) What type of cell division is occurring?
 - (b) List the genotypes of the daughter cells.
 - (c) What is the significance of crossing over during the process of gamete formation?
17. Detail ONE way in which each of the following protects the body from harmful bacteria.
- (a) Skin
 - (b) pH levels in the stomach
 - (c) Cilia in the respiratory tract

- 18.** (a) Most plants rely on turgor pressure in cells to maintain the stems and leaves in an erect position. Explain how this turgor is maintained in plant cells.
- (b) Describe a structural adaptation of some desert plants to obtain water from extremely dry soils.
- (c) Give ONE example of either a physiological or behavioural adaptation of desert plants to survive in their moisture-deficient environments.
- 19.** Haemophilia is a sex-linked recessive disease.
- (a) What is the term given to an individual who has the gene for haemophilia but does not exhibit the phenotype for the disease?
- (b) Haemophilia can be passed from a grandfather to his grandson without it being expressed in the grandson's parents. Construct a diagram, or family tree, or pedigree to show this.
- 20.** Some oysters growing in sewage-contaminated water become sick and die.
- How would a biologist use Koch's postulates to demonstrate that the oysters died as a result of a bacterial infection?
- 21.** Histones are proteins that are essential for eucaryotic DNA replication. The amino acid sequence of specific plant histones is almost, but not exactly, identical to that of whale histones.
- (a) What does this tell us about the relationship between the amino acid sequence and the function of histones?
- (b) How does Darwin's theory of evolution explain the similarity of whale and plant histones?
- 22.** An epidemic occurs when a micro-organism is successful in rapidly infecting a large number of people. Select a pathogen.
- (a) What THREE features of the pathogen AND/OR the host make an epidemic likely?
- (b) Give a reason why EACH feature makes an epidemic likely.
- 23.** (a) Explain why most terrestrial organisms have internal respiratory surfaces.
- (b) State TWO adaptations that allow efficient gaseous exchange in terrestrial organisms.

- 24.** Complete the table in the Answer Book to explain how **THREE** abiotic characteristics differ between a deep lake and a desert environment.
- 25.** Explain in terms of modern evolutionary theory:
- (a) why there are so many simple organisms still in existence;
 - (b) why sharks have undergone little structural change for millions of years;
 - (c) why some highly evolved organisms, such as dinosaurs, become extinct.

PART C

Questions 26–31 are worth 5 marks each.

Answer this Part in the Part C Answer Book.

- 26.** The jerboa hopping mouse has long hind legs, a brush-tipped tail and large ears. It comes out to feed at night and spends the day hidden in its burrow. The urine it excretes is highly concentrated. The female has a short pregnancy and its young can be weaned off their mother's milk only twenty-four days after birth.

- (a) List TWO physical features of the environment suggested by these adaptations.
- (b) Indicate whether the following adaptations are structural, physiological or behavioural. Detail how the adaptations may assist the jerboa hopping mouse to survive in this environment.
 - (i) Nocturnal feeding
 - (ii) Large ears
 - (iii) Short pregnancy
 - (iv) Concentrated urine

- 27.** In pea pods, some pods are green and others are yellow. One of these characteristics is dominant, while the other is recessive. A plant geneticist wanted to determine which characteristic was dominant. Accordingly, he carried out crosses between different plants *A*, *B*, *C* and *D*. The results of these crosses are shown below.

<i>Crosses</i>	<i>F₁ Generation</i>
<i>A</i> (green) × <i>B</i> (green)	All green
<i>A</i> (green) × <i>D</i> (yellow)	All green
<i>B</i> (green) × <i>C</i> (green)	77 green : 23 yellow
<i>B</i> (green) × <i>D</i> (yellow)	102 green : 98 yellow

- (a) Which pod colour is dominant?
- (b) How can you tell that plant *A* is a pure-breeding plant with green pods?
- (c) What is the genotype of plant *D*? Explain your answer.
- (d) What is the expected phenotypic ratio of the offspring of a cross between plant *A* and plant *C*? Show all working.
- (e) Do the results from the cross between plants *B* and *D* confirm Mendel's ratios? Explain your answer.

- 28.** (a) How can the comparison of present day life forms with fossils be used to provide evidence supporting the theory of evolution? Justify your answer with specific examples that you have studied.
- (b) Explain how each of the following provides additional evidence in support of the theory of evolution:
- (i) the age of the Earth;
 - (ii) homologous structures;
 - (iii) 'transitional' forms.
- 29.** Three people (X, Y and Z) were exposed to the same dose of pathogenic bacteria. Person X became very sick and died after three days. Person Y became very sick but had recovered by day five. Person Z did not become sick at all.
- (a) Give ONE reason why person Y would take less time to recover if exposed to the same bacteria again. In your answer, discuss the mechanisms involved.
- (b) Explain why person Z might get sick if exposed to different pathogenic bacteria.
- (c) Give ONE reason why injection of these pathogens into individuals would not be an effective way of immunising a community.
- (d) What would be a better method to immunise the population?
- 30.** In a remarkable experiment conducted in 1775, two men walked into an oven in which the air was dry and had been heated to 127°C. After 20 minutes they emerged unharmed. In contrast, a piece of steak that they carried in with them had partially 'cooked'.
- (a) Discuss what mechanisms would have been operating to have enabled the men to survive.
- (b) Would a lizard have been able to survive under the same conditions? Give reasons.
- (c) If it is possible to survive such temperatures, give a reason why some people die on humid days when the temperature is 45°C?
- (d) Explain why it is important to maintain a constant body temperature.
- 31.** (a) What is a parasite?
- (b) Name a macroscopic parasite that you have studied and its host.
- (c) For this named macroscopic parasite, describe TWO adaptations that enable it to successfully live a parasitic existence.
- (d) Describe TWO effects that this macroscopic parasite has on its host and how these effects are produced.

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SECTION II—ELECTIVES

(25 Marks)

Attempt ONE question.

Each question is worth 25 marks.

Answer the question in a SEPARATE Elective Answer Book.

	Pages
QUESTION 32. The Australian Environment	14–15
QUESTION 33. Structure and Function of Cells and Tissues	16–17
QUESTION 34. Control and Coordination	18–19
QUESTION 35. Classification and the Species Concept	20–23
QUESTION 36. The Human Species	24–26
QUESTION 37. Genes in Action	28–29
QUESTION 38. Human Environmental Impact	30–31

QUESTION 32. The Australian Environment**Marks**

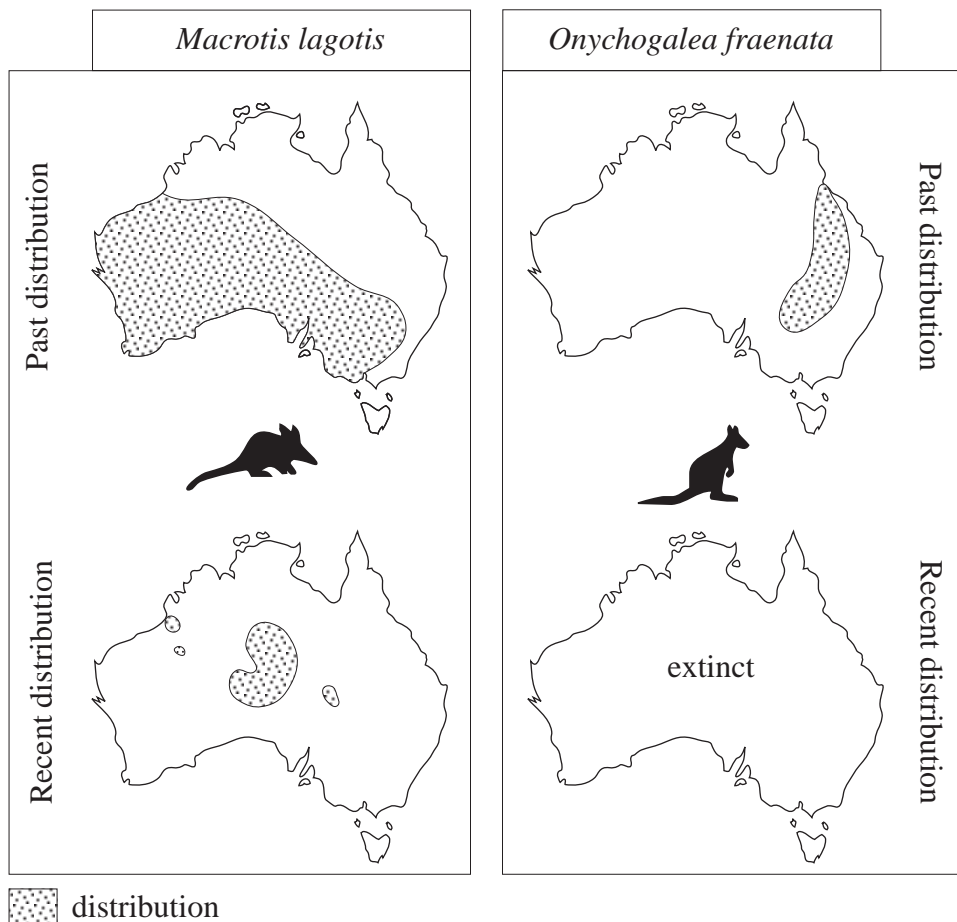
- (a) (i) Name a member of the Myrtaceae or Proteaceae family that you have studied. **5**
- (ii) Describe how its present distribution is related to:
1. human activity;
 2. topography;
 3. climate.
- (iii) Outline how climate change and the theory of continental drift may be used to explain the present distribution of some plant species.
- (b) (i) Name a local ecosystem that you have studied. **8**
- (ii) For this ecosystem:
1. draw a simple food web and label TWO indigenous and TWO introduced organisms;
 2. suggest TWO consequences if BOTH introduced species are removed;
 3. detail the life cycle of ONE plant and ONE animal. What impact does *each* have on the area dynamics?
- (c) (i) Name an animal species in the ecosystem you have studied. Outline ONE method that could be used to determine its distribution and ONE method that could be used to determine its abundance. **4**
- (ii) For each method used in part (c) (i), give ONE advantage and ONE disadvantage of the method.

Question 32 continues on page 15

QUESTION 32. (Continued)

Marks

(d)



The diagram above represents the suggested decline in distribution of medium-sized marsupials over a 200-year period since European settlement.

8

- (i) Describe THREE ways in which introduced species may have reduced the range and numbers of these marsupials.
- (ii) List TWO factors, other than introduced species, that may have led to this reduction.
- (iii) Describe THREE ways humans may be able to increase the range and numbers of these marsupials.

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

- (a) In an experiment, yeast cells were grown in two solutions, *A* and *B*. Solution *A* was well oxygenated but solution *B* contained no oxygen. The yeast grew at the same rate in both solutions. The yeast cells in solution *B* used glucose about fifteen times faster than the cells in solution *A*. **6**
- (i) Draw a diagram to show what happened to glucose molecules in solution *A*. Label the relevant biochemical pathways.
 - (ii) Which of these pathways could NOT be used by the yeast cells in solution *B*? Explain your answer.
 - (iii) Explain why glucose was used at a faster rate in solution *B*.
 - (iv) When all the glucose has been used, in which solution, *A* or *B*, would the yeast cells have produced the most carbon dioxide? Justify your answer.
- (b) Chloroplasts were isolated from spinach leaves and placed in a solution in a transparent tube. The oxygen concentration of the solution in the tube was continually monitored. When a white light was placed next to the tube, the oxygen concentration in the solution increased. **7**
- (i) Outline the steps by which oxygen was produced in the solution.
 - (ii) How would the rate of oxygen production have differed if green light had been used? Explain your answer.
 - (iii) What would have happened if pure chlorophyll had been added to the solution instead of the chloroplasts? Explain your answer.
 - (iv) How are the products of the light reaction of photosynthesis used in carbon dioxide fixation?
 - (v) Sugar is produced by the carbon dioxide fixing reactions. Name TWO ways plants use this sugar.
- (c) **3**
- (i) Name a specialised animal cell that you have studied.
 - (ii) Draw a diagram of this cell. Label THREE features of the cell.
 - (iii) Explain how the specialisation of this cell relates to the function of the whole tissue.

Question 33 continues on page 17

QUESTION 33. (Continued)

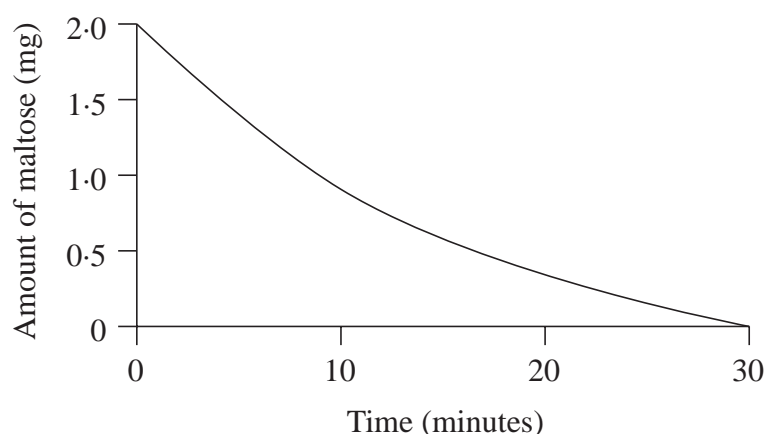
Marks

- (d) The enzyme maltase catalyses the breakdown of the sugar maltose into two glucose molecules. The enzyme works most efficiently at pH 6.8. Maltase does not break down sucrose, which consists of a glucose and fructose molecule. 5

(i) Draw or describe a model of enzyme action that can be used to explain why:

1. maltase works specifically on maltose;
2. maltase activity is sensitive to pH.

(ii) A sample of maltase was added to a solution at pH 6.8 containing 2 mg maltose. The breakdown of maltose was monitored over the next 30 minutes. The results are shown below.



For this enzyme-catalysed reaction, describe what would happen in EACH of the following circumstances.

1. Twice as much enzyme is added at time zero.
2. The reaction is performed at pH 6.0.
3. A further 2 mg maltose is added after 30 minutes.

- (e) (i) Using labelled diagrams, show the structural changes that a newly formed root tip cell undergoes as it makes the transition to a differentiated root cell. 4

(ii) For ONE type of differentiated plant cell, describe:

1. ONE structure that distinguishes that cell type from other cells in the plant;
2. how that structure enables the cell to perform its specialised function.

QUESTION 34. Control and Coordination**Marks**

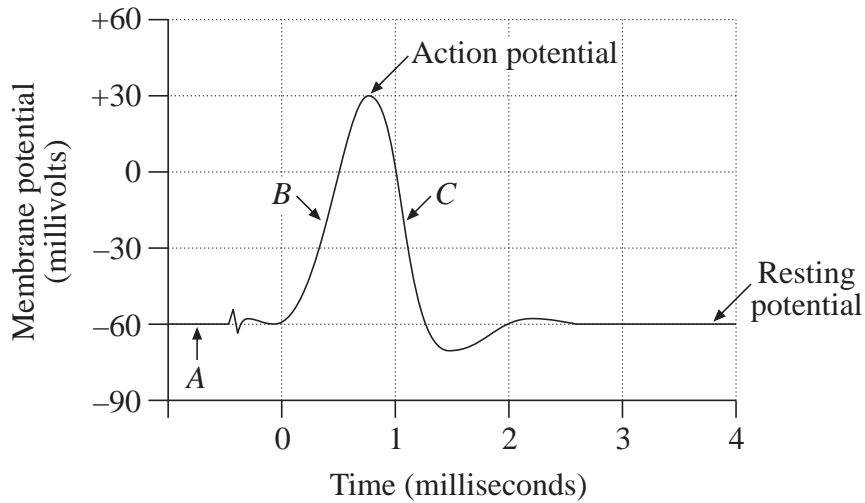
- (a) Homeostasis in most animals is controlled by interactions between the nervous and endocrine systems. **4**
- (i) Name THREE differences between hormones and nerve impulses.
 - (ii) What region of the brain acts as a link between the nervous system and the pituitary gland? How does it regulate the pituitary gland?
- (b) (i) Name a pituitary hormone that you have studied AND its target organ. **4**
- (ii) How is the rate of secretion of this pituitary hormone controlled? In your answer, include how the nervous system, hormone or chemical substance controls the secretion.
 - (iii) In your example, if the mechanism that controls hormone release from the pituitary gland were inhibited by an abnormal condition, predict what would happen to the rate of pituitary hormone secretion. Explain your answer.
- (c) Many different hormones circulate in the blood. Use a labelled diagram to explain how hormones act only on their target tissue(s). **2**
- (d) (i) What is *phototropism*? **5**
- (ii) Using a flowchart ($A \rightarrow B \rightarrow C$ etc.), give examples of at least FIVE components of the phototropic response. Indicate clearly on your chart which part of the response is the 'stimulus', 'receptor', 'hormone', 'cellular response', and 'plant response'.
 - (iii) What is the advantage to the plant of this tropic response?
- (e) Draw a diagram of a typical motor neurone. **4**
- (i) On your diagram, clearly label at least TWO structures found only on neurones.
 - (ii) Indicate on the diagram where neurotransmitters are normally released.
 - (iii) Use an arrow to show the normal direction of the nerve impulse.
- (f) Certain neurotransmitters are broken down by enzymes found in the synapse. Some drugs inhibit the action of these enzymes. Predict ONE short-term consequence if these enzymes are blocked. **1**

QUESTION 34. (Continued)

Marks

- (g) The following diagram shows the resting and action potentials recorded from an axon displayed on a cathode ray oscilloscope.

5



- (i) What process maintains the resting membrane potential at -60 mV at A? What would happen if this process were blocked?
- (ii) What ions move across the membrane at B? In which direction do they move?
- (iii) What ions move across the membrane at C? In which direction do they move?
- (iv) If the action potential were recorded from another point further along the same axon, would it be the same as or different to the one in the diagram above? Explain your answer.

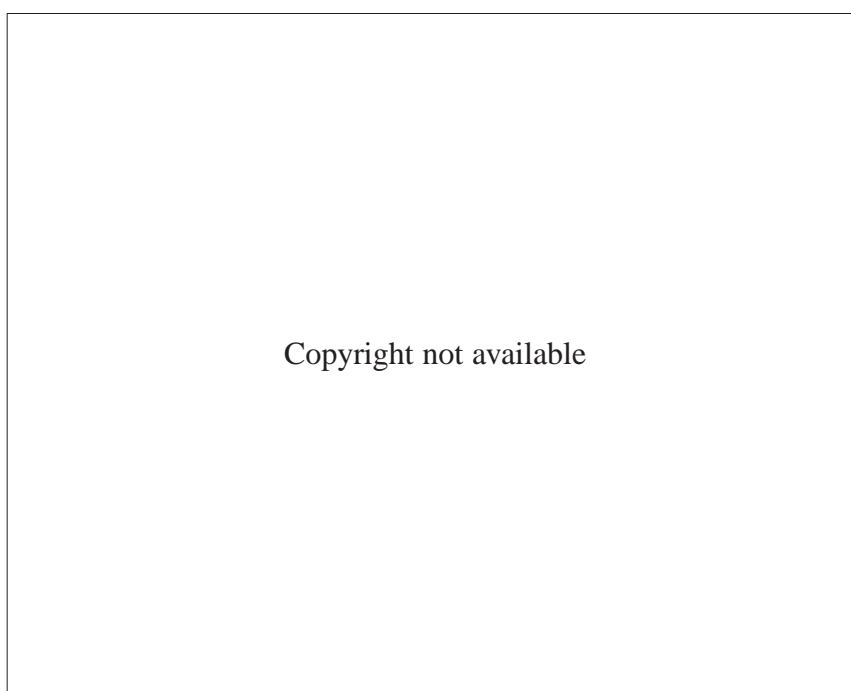
QUESTION 35. Classification and the Species Concept**Marks**

- (a) (i) Put the following terms in order, starting with the one containing the largest groups of organisms: **3**

- phylum
- species
- kingdom
- genus
- order
- class.

- (ii) Scientists often have difficulty in classifying organisms as separate species. Using the biological species concept, how would you determine if two organisms belong to separate species?

- (b) The following question refers to the diagram below. **3**



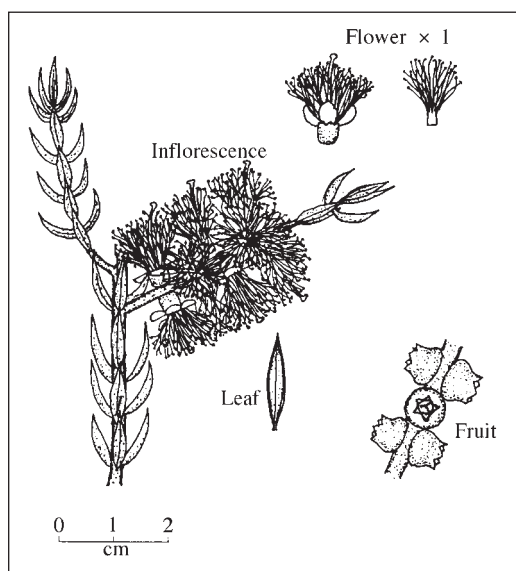
- (i) What categories of classification are represented by the names shown on the diagram?
- (ii) Outline THREE rules applied in the use of the binomial system in the naming of organisms.

Question 35 continues on page 21

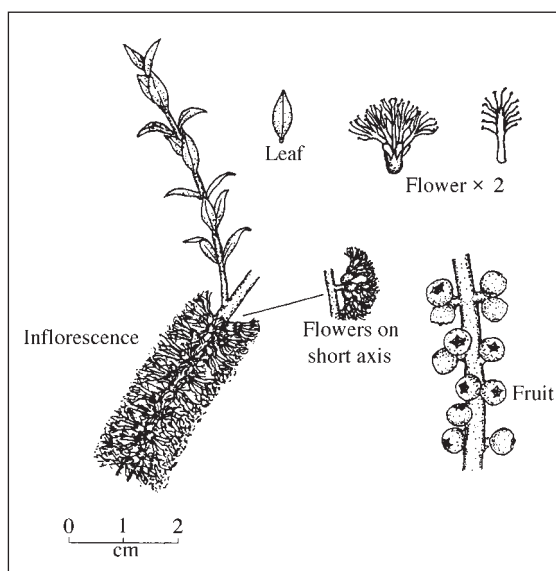
QUESTION 35. (Continued)

Marks

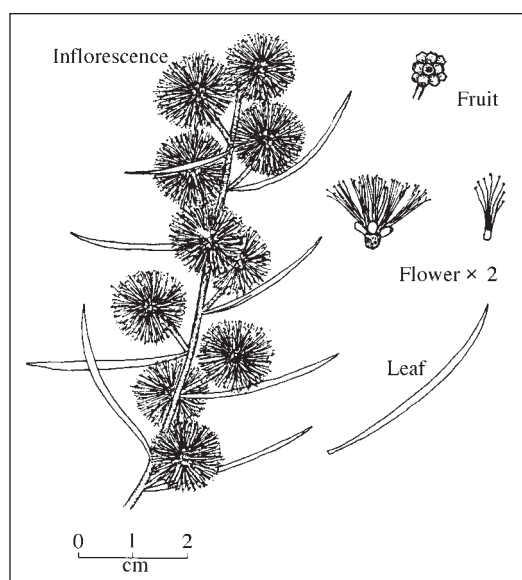
- (c) (i) Give the scientific name of a family of plants that you studied. Using the binomial system, give the names of TWO species within that family. 6
- (ii) For the family you named in part (c) (i), give ONE distinguishing floral characteristic common to that family.
- (iii) The following diagrams are of three plant species from the same genus.



SPECIES 1



SPECIES 2



SPECIES 3

Original sketches by Ivan Holliday, A Field Guide to Melaleucas, Hamlyn Australia, 1989

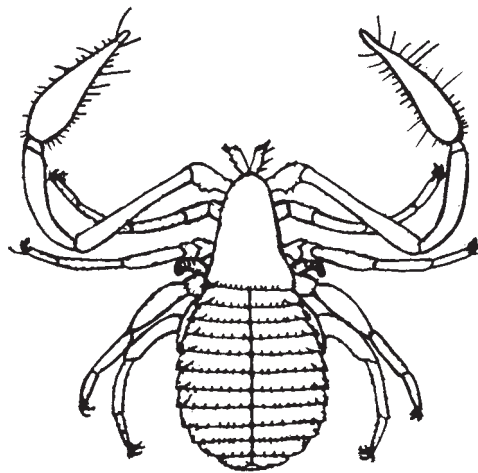
List THREE distinguishing features, and describe in detail how you could use EACH to distinguish between these three species in the field.

Question 35 continues on page 22

QUESTION 35. (Continued)

Marks

- (d) (i) Explain how speciation can occur in the absence of geographical isolation. **6**
- (ii) Sometimes populations can be geographically isolated for millions of years without diverging into separate species. Give THREE mechanisms that might contribute to the isolated species not diverging.
- (iii) Describe ONE way genetic variability may be increased within a population.
- (iv) Describe ONE way genetic variability may be reduced within a population.
- (e) (i) What is a *cline*? **3**
- (ii) How do clines contribute to our understanding of the process of speciation?
- (f) (i) Is the organism shown below an insect? Describe TWO features that justify your decision. **4**

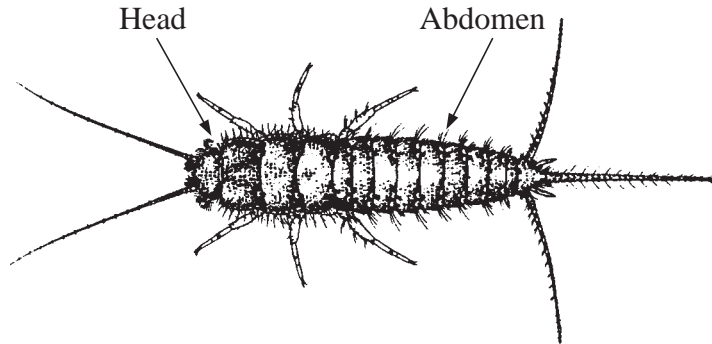


Question 35 continues on page 23

QUESTION 35. (Continued)

Marks

- (ii) Using the key provided, identify the order to which the organism, pictured below, belongs. List the numbers in the steps of the key that you used in reaching your decision.



Classification key	
1. (a) Wings present	5
1. (b) Wings absent	2
2. (a) Abdomen with six segments or less	Collembola
2. (b) Body more elongated with more than six segments	4
3. (a) Antennae and eyes absent, forelegs held upward	Protura
3. (b) Longer, slender antennae	5
4. (a) Three long bristles at the end of the abdomen, antennae held forward	Thysanura
4. (b) Two long bristles at the end of the abdomen	Diplura
4. (c) Three long bristles at the end of the abdomen with antennae held close to the body	Archaeognatha
5. (a) Last abdominal segment bears a pair of curved forceps	Dermaptera
5. (b) Forewings very hard and do not take part in flight	Coleoptera

- (iii) To which phylum and class does the organism pictured in part (ii) above belong?

QUESTION 36. The Human Species**Marks**

- (a) (i) List TWO features of mammals that distinguish them from other animals. **3**
- (ii) Name TWO primates (other than humans) and state TWO features that could be used to classify them as primates.

- (b) Characteristics such as 'social structure' and 'impact on the biosphere' may be used by scientists to help classify some archaeological finds as *Homo sapiens*. **3**

Select ONE of the above characteristics.

- (i) Name TWO types of evidence for this characteristic. Describe how each could help scientists demonstrate that a fossil may be an example of *Homo sapiens*.
- (ii) Suggest ONE difficulty that may arise in the interpretation of this type of evidence.
- (c) Using specific examples, discuss how increased palaeontological and other evidence have led to: **2**
- (i) changed views within the scientific community concerning the evolution of modern humans;
- (ii) different theories of human evolution based on the same evidence.

- (d) The Cro-Magnon people were an early example of *Homo sapiens* who inhabited Europe. **3**

List THREE areas of cultural development evident in *Homo sapiens* during the last 40 000 years. Outline how EACH has been of benefit in human development.

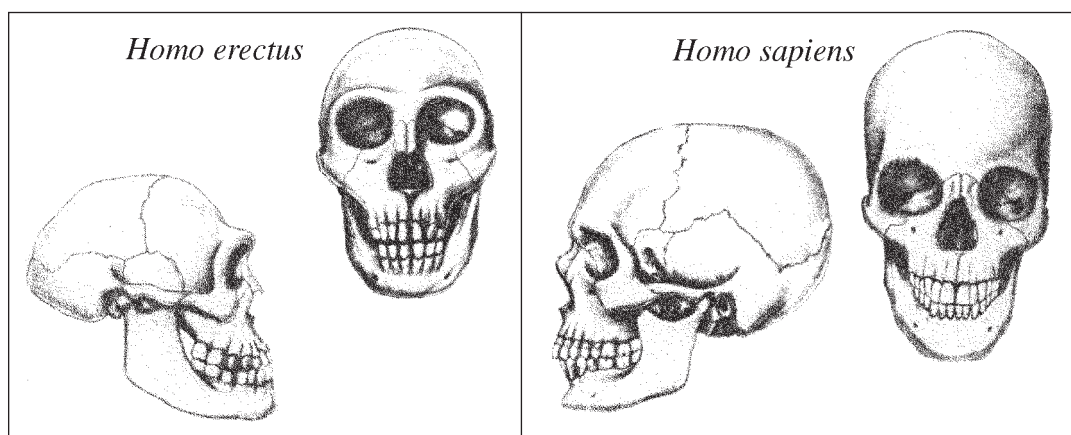
Question 36 continues on page 25

QUESTION 36. (Continued)

Marks

- (e) Below are reconstructions of *Homo erectus* and *Homo sapiens* skulls.

3



Biology: 1986 by Peter H Raven and George B Johnson, p 484, 1986, © The McGraw – Hill Companies, Inc

- (i) Identify TWO physical differences between the skulls of *Homo erectus* and *Homo sapiens* that are regarded by scientists as evolutionary advances.
 - (ii) Explain how ONE of these differences has enabled the evolutionary advancement of humans.
- (f) Scientists have identified a number of migrations from South-East Asia to the Australian continent that could have played a role in the evolution of the Australian Aborigine.

3

Describe:

- (i) palaeontological evidence that could be used to support this conclusion;
- (ii) archaeological evidence that could be used to support this conclusion;
- (iii) ONE other form of evidence that could be used to interpret such events from the past.

Question 36 continues on page 26

QUESTION 36. (Continued)

Marks

- (g) (i) *Homo sapiens* is a polymorphic species. Name TWO physical differences within the species *Homo sapiens* that produce advantages for individuals under certain conditions. **4**
- (ii) How does EACH of the above physical differences result in an adaptive advantage for *Homo sapiens*?
- (h) (i) List TWO genetic techniques developed by modern scientists. Describe how EACH technique might affect the future evolution of *Homo sapiens*. **4**
- (ii) How can the following influence the evolution of the human species?
- Birth control
 - Medicine

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QUESTION 37. Genes in Action**Marks**

- (a) (i) Explain clearly how the mechanism of inheritance of the human ABO blood group system is different to that for human height. **5**
- (ii) Mary, whose father is blood group AB and whose mother is blood group A, marries a man called Bruce who is blood group B. Mary and Bruce have two children, one of whom is blood group O and the other, blood group A.
- For the ABO blood groups:
1. What is the phenotype and genotype of Mary?
 2. What is the genotype of Bruce?
 3. What is the genotype of Mary's mother?
- Show all working.
- (b) (i) Explain why the genetic code requires triplets of bases to specify an amino acid, rather than just pairs of bases or single bases. **6**
- (ii) 1. Describe in detail the process of messenger RNA (m-RNA) formation and state where in the cell it takes place.
2. Outline clearly the role of ribosomes AND transfer RNA (t-RNA) in the process of protein synthesis.
- (c) (i) Name a genetic disease or condition caused by a chromosome number change. **2**
- (ii) What effect does this have on the organism?
- (iii) Describe one other form of chromosomal mutation other than a change in chromosome number.
- (d) Four genes, A, B, C and D, were found to be linked on a chromosome but the degree of linkage between each pair differed. Describe how you would determine the relative order of the four genes along the chromosome. **2**

Question 37 continues on page 29

QUESTION 37. (Continued)

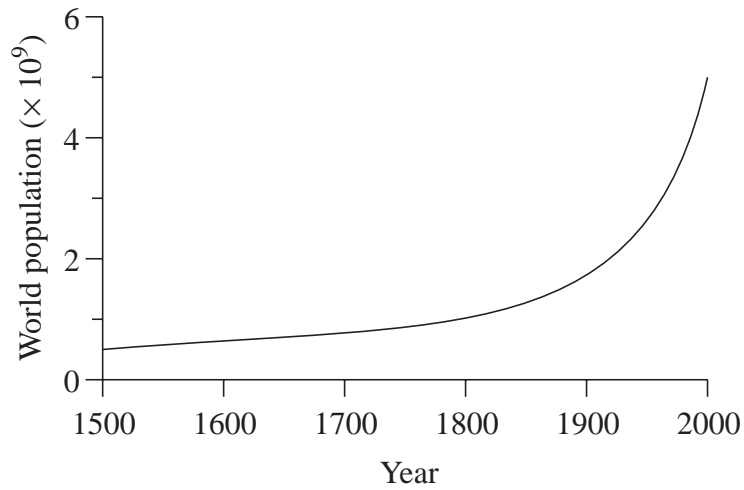
Marks

- (e) (i) If a mutagen caused a single base–pair substitution in a gene, describe **THREE** possible outcomes for the polypeptide coded by that particular gene. Explain **EACH** answer, giving a reason for the outcome. **4**
- (ii) Some mutagens can induce frameshift mutations. What is a frameshift mutation?
- (f) (i) What is *recombinant DNA*? **4**
- (ii) Outline the steps involved in the production of recombinant human insulin.
- (iii) Describe **ONE** type of genetic manipulation where hybridisation between different species has been used to improve an agricultural product.
- (g) Alzheimer’s disease causes irreversible memory loss and impaired judgement. At least three genes are known to be involved in Alzheimer’s disease. Once a defect in one of these genes is identified in a family member, other family members can be tested for the mutation. **2**

Describe **TWO** ethical issues that one would need to consider prior to testing and diagnosis of the disease in other family members.

QUESTION 38. Human Environmental Impact**Marks**

- (a) The following question refers to the graph below.

3

Outline **THREE** factors that kept world population relatively stable between AD 1500 and AD 1700.

- (b)

3

The diagram above shows a transect of natural bushland. A farmer clears this land for agricultural purposes. Describe **THREE** effects of land clearance in such an area.

Question 38 continues on page 31

QUESTION 38. (Continued)

Marks

- (c) Astronauts orbiting the Earth observe the ever-increasing urbanisation of the planet. Describe in detail how EACH of the following factors associated with urbanisation affects our environment. **6**
- (i) Environmental modifications
 - (ii) Pollution
 - (iii) Waste disposal
- (d) (i) Name ONE introduced species in the Australian environment. **3**
- (ii) Why has this species successfully populated areas of the Australian environment?
- (iii) Name a native species that has been affected by the introduced species and explain the impact.
- (e) Describe TWO advantages and TWO disadvantages of 'controlled burning' in Australian native bushland. **2**
- (f) The burning of fossil fuels provides an extremely large proportion of the energy that industrialised society uses for transport, heating and lighting. **6**
- (i) What is a fossil fuel? Give ONE example.
 - (ii) Outline THREE harmful effects that the burning of fossil fuels has on the environment.
 - (iii) Name TWO renewable energy sources. Explain how the use of these energy sources is less harmful to the environment than non-renewable energy sources.
- (g) Outline ONE environmental and ONE economic effect of resource stripping on the natural environment. **2**

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