

BOARD OF STUDIES
NEW SOUTH WALES

HIGHER SCHOOL CERTIFICATE EXAMINATION

1999
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 either blue or black pen 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.

- 1 The following base sequence of DNA is the result of the replication of a double-stranded segment of DNA.

G A A T T C

C T T A A G

Which of the base sequences below is the original DNA?

(A) G A A T T C
G A A T T C

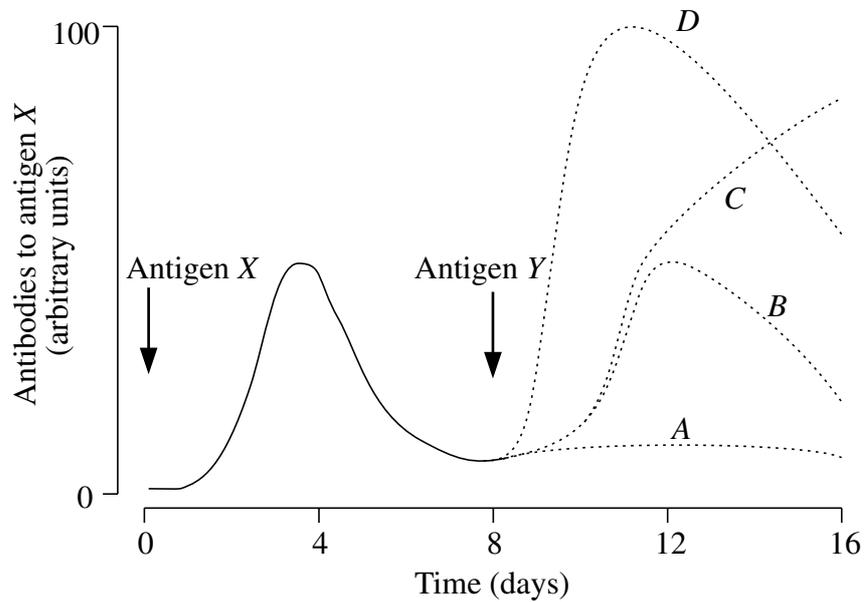
(B) C T T A A G
C T T A A G

(C) G A A T T C
C T T A A G

(D) C A T T A C
G T A A T C

- 2 A person was exposed to antigen X on day 0. On day 8, the same person was exposed to a completely different antigen, antigen Y.

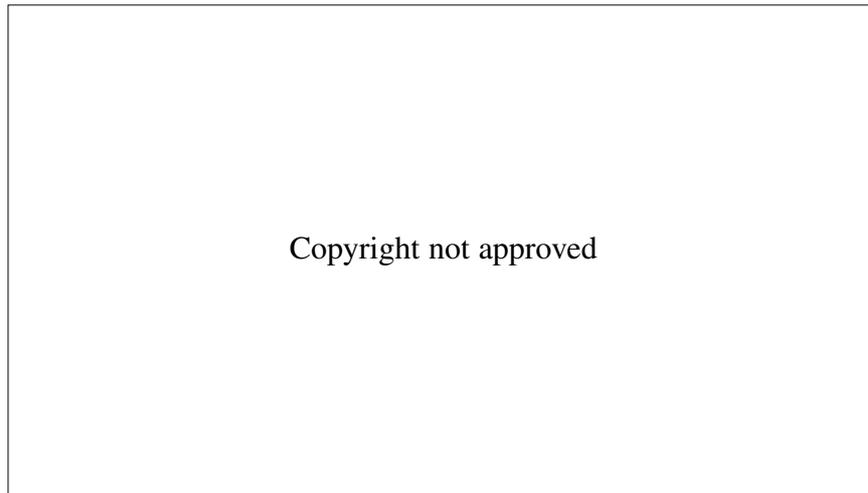
The graph shows the number of antibodies to antigen X measured in the person's blood up to day 8.



Which line best depicts the level of antibodies to antigen X from day 8 to day 16?

- (A) A
(B) B
(C) C
(D) D

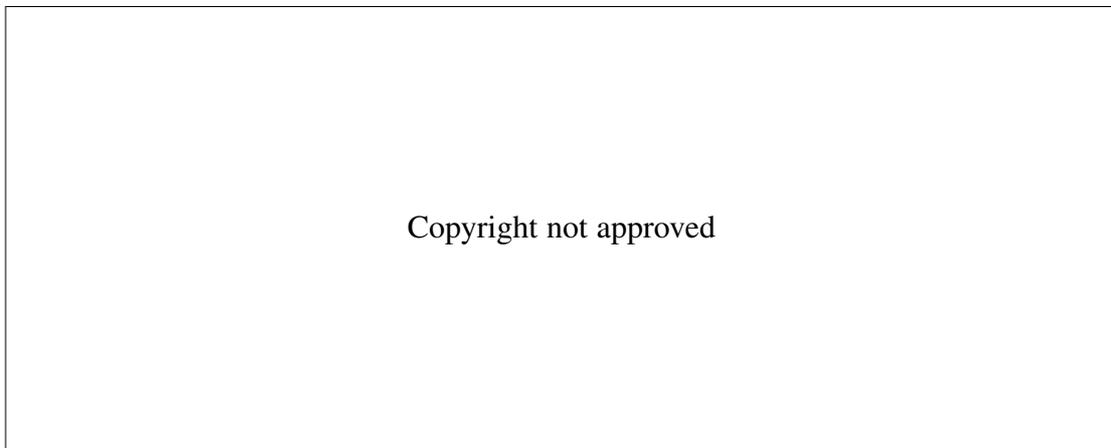
- 3 The picture shows a lungfish. The lungfish is an aquatic organism which, during dry periods, can survive on land for a few weeks before the next wet period.



Which of the following refers to a *physiological* adaptation that helps it survive during a dry period?

- (A) The lungfish has short appendages which can act as limbs to allow it to move on land.
- (B) The lungfish excretes a more dilute urine when it is on land.
- (C) The lungfish excretes a concentrated urine rich in urea when it is on land.
- (D) The lungfish burrows to avoid water loss when it is on land.

- 4 The diagram represents some environmental conditions measured above and below the water surface of a deep lake on a summer day. The way in which the levels of four abiotic characteristics change with depth is represented by the columns I, II, III and IV.

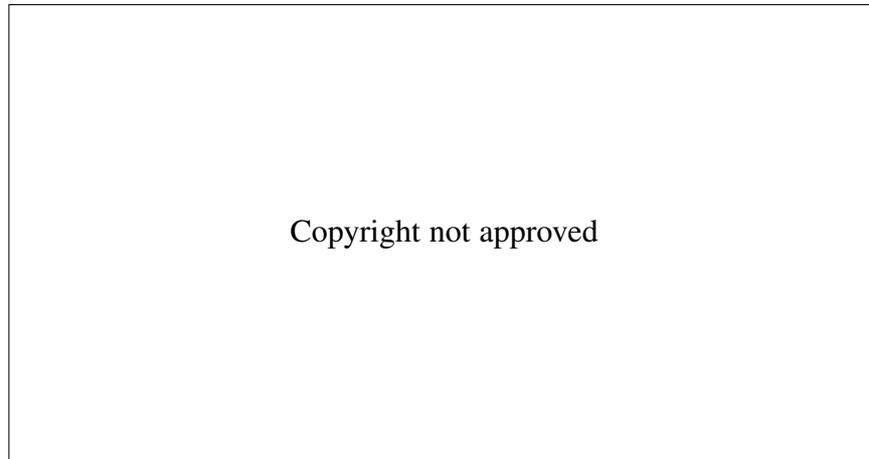


Which abiotic characteristic is best represented by each column?

	I	II	III	IV
(A)	Light	CO ₂	Temperature	O ₂
(B)	Light	Temperature	O ₂	CO ₂
(C)	CO ₂	Temperature	Light	O ₂
(D)	O ₂	Light	Temperature	CO ₂

- 5 In humans, *B* represents the dominant eye colour brown and *b* represents the recessive eye colour blue. What are the genotypes of two brown-eyed parents who produce a blue-eyed child?
- (A) *BB* and *bb*
- (B) *BB* and *Bb*
- (C) *bb* and *bb*
- (D) *Bb* and *Bb*

- 6 The diagram shows the bones in the hind-limbs of five modern vertebrates. The dotted lines link similar structures.



These homologous structures support the theory of evolution because they show

- (A) transitional forms of the same species.
 - (B) that the dog is a transitional form between the horse and human.
 - (C) that they may have had a common ancestor.
 - (D) vestigial features (no major function).
- 7 Natural selection is the process by which organisms
- (A) best suited to the environment produce offspring that survive.
 - (B) that are the most physically fit survive.
 - (C) pass on acquired characteristics to their offspring.
 - (D) change slowly over time.

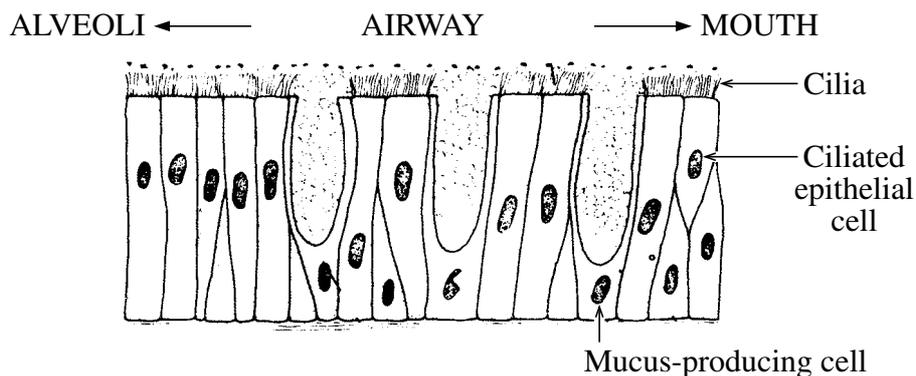
8 Bubonic plague is caused by the bacterium *Yersinia pestis*. The bacterium is spread by fleas which bite either rats or humans. The following information concerning bubonic plague has been determined by scientists:

- Fleas die about five days after biting and ingesting blood from infected humans or rats.
- Most infected rats do not die, but carry the bacterium.
- Fleas do not bite dead animals.

Bubonic plague would spread more quickly through human populations if

- (A) *Yersinia pestis* took more time to kill fleas.
 (B) *Yersinia pestis* killed more rats.
 (C) rats and humans were kept apart.
 (D) dead rats were burnt.

9 The diagram shows a cross-section of a bronchiole in the human respiratory tract.

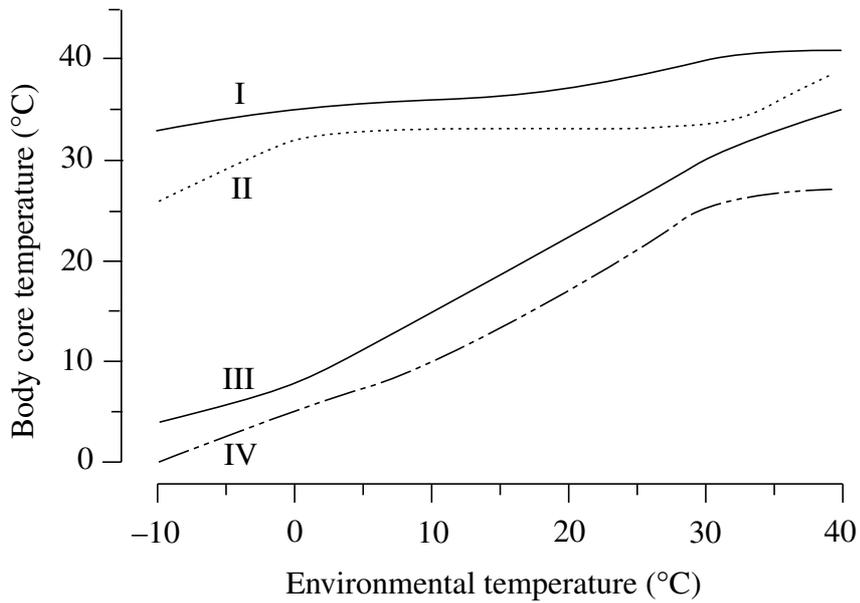


King, R J & Sullivan, F M, *Senior Biology*, Longman Cheshire, Melbourne, 1991.
 Reproduced with permission of the publisher, Pearson Education Australia

What is the main role of the cilia?

- (A) To trap dust particles
 (B) To move mucus towards the mouth
 (C) To move air towards the alveoli
 (D) To provide a large surface area for gas exchange

- 10 Four different animals were maintained in a laboratory in habitats similar to that of their natural environment. The body core temperature of the animals was measured in response to changes in the temperature of the laboratory environment.



Which of the following statements is best supported by the data?

- (A) Animal I maintains its body core temperature relatively constant by shivering when the environmental temperature falls below 37°C.
- (B) Animal II is homoiothermic (endothermic) over the environmental temperature range of zero to 30°C.
- (C) Animals I and II are most likely mammals.
- (D) Animal IV is most likely a marine mammal.

- 11 Four pieces of celery, of equivalent size and shape, were placed in four solutions of different sucrose concentrations.

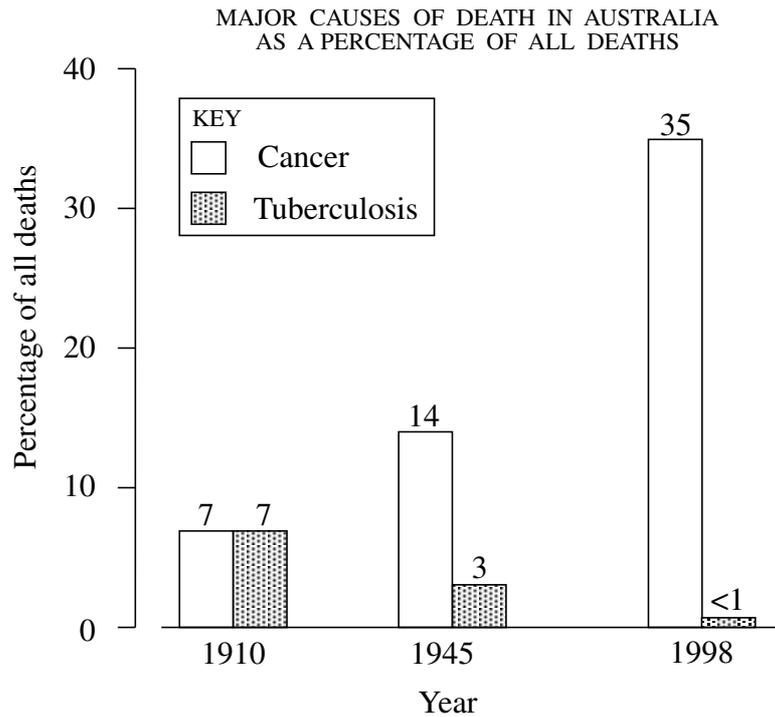
The table shows the results of weighing the celery before, and two hours after, being placed in the solutions.

<i>Celery in</i>	WEIGHT (g)	
	<i>Before</i>	<i>After</i>
Solution A	49.7	50.1
Solution B	49.8	46.1
Solution C	49.9	60.2
Solution D	49.6	42.3

Which sucrose solution was the most concentrated?

- (A) Solution A
 - (B) Solution B
 - (C) Solution C
 - (D) Solution D
- 12 A pathogen passed from a mother to an unborn baby across the placenta causes a disease which is
- (A) infectious.
 - (B) genetic.
 - (C) nutritional.
 - (D) environmental.

13



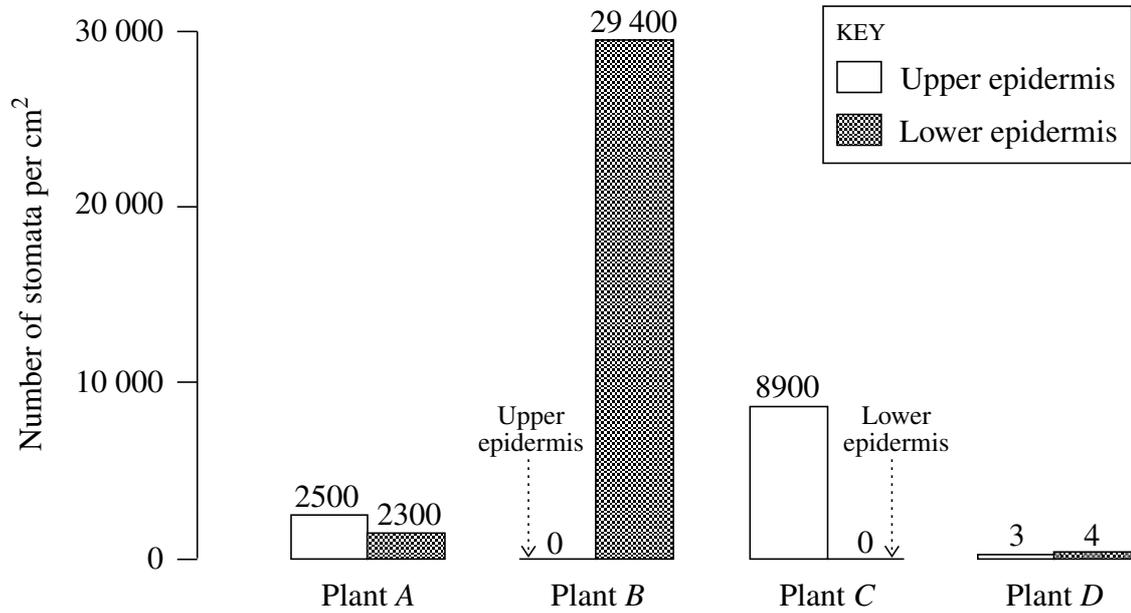
What does the graph show?

- (A) The people who would once have died of tuberculosis now die of cancer.
- (B) By 2010 fifty per cent of all deaths will be due to cancer.
- (C) By 2010 tuberculosis will be eradicated.
- (D) Most deaths in Australia are not due to cancer.

14 What is the end result of a cell dividing by the process of meiosis?

- (A) Two new cells that are genetically identical.
- (B) Two new cells that are not genetically identical.
- (C) Four new cells that are genetically identical.
- (D) Four new cells that are not genetically identical.

- 15 The graph shows the distribution of stomata on the upper and lower epidermis of the leaves of four plants.



Which of these plants would you predict to find floating on the surface in an aquatic environment?

- (A) *A*
 (B) *B*
 (C) *C*
 (D) *D*

PART B

Questions 16–25 are worth 3 marks each.

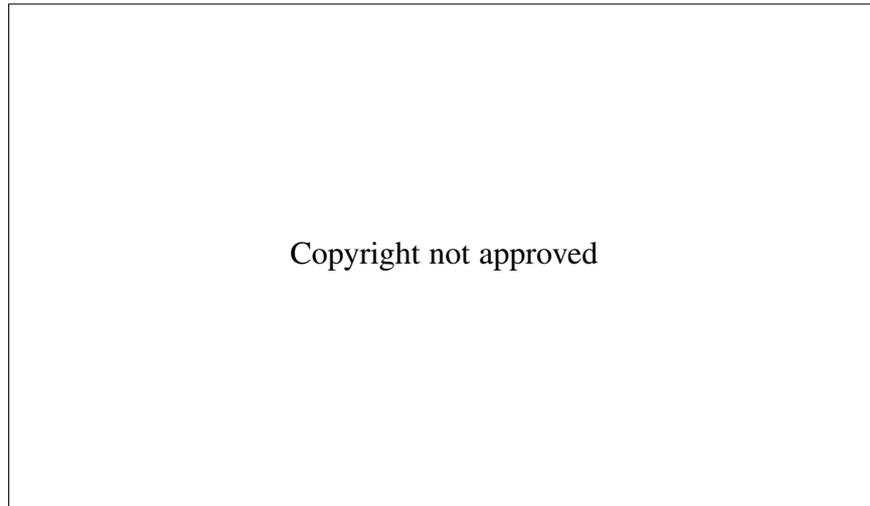
Answer this Part in the Part B Answer Book.

- 16** The data in the table show the number of babies with Down's syndrome born to mothers of different ages.

<i>Mother's age</i> (years)	<i>Number of Down's syndrome babies</i> (per 10 000 births)
20	4
25	6
30	8
35	11
40	35
45	100
50	217

- (a) Draw a graph to illustrate the data in the table.
- (b) Describe the relationship between the age of the mother and the occurrence of Down's syndrome in their babies.

- 17** The diagram shows a typical swim bladder in a fish.



Gas from the blood may be added to, or removed from, the swim bladder.

- (a) What is the function of the swim bladder in an aquatic environment?
 - (b) What is the advantage of the swim bladder for a fish?
 - (c) Why do humans usually require a weighted belt in order to remain submerged in water?
- 18** Describe the method of protection against invasion by pathogens at the following points of entry into the human body.
- (a) Skin
 - (b) Alimentary canal
 - (c) Urogenital surface

19

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The sea lamprey is a parasitic jawless fish that migrates to reproduce in freshwater pools. This results in larvae that mature into adult lampreys in fresh water. These young adults then migrate to the sea.

- (a) A major change during migration of the young adult lamprey is an alteration in ion concentration in the water. Describe how the lamprey may adapt to this change in its environment.
- (b) Describe how TWO additional abiotic characteristics differ between the freshwater pool and the sea.

20 You have examined fossils and compared them with present day forms.

- (a) Describe ONE similarity and ONE difference between a NAMED fossil and a NAMED present day form.
- (b) How does the study of fossils and present day forms support the theory of evolution?

21 There are populations of geckos (a small type of lizard) that consist of all-female members. They reproduce asexually by a process called parthenogenesis, in which the offspring develop from unfertilised eggs. There are other populations that have male and female members which reproduce sexually.

- (a) Give ONE advantage and ONE disadvantage of reproducing asexually.
- (b) If the populations of geckos were to experience a long period of climate change, which population (sexually or asexually reproducing) would be more likely to survive? Explain your answer.
- (c) Would you expect all populations of asexually reproducing geckos to be genetically similar? Explain your answer.

22 Describe the function of the following types of cells in the immune response.

- (a) Phagocytes
- (b) B-lymphocytes
- (c) T-lymphocytes

- 23** (a) Many plants can remain upright despite a lack of woody tissue. Explain how this occurs in:
- (i) terrestrial plants;
 - (ii) aquatic plants.
- (b) How do some animals maintain their body shape without a hard skeleton?
- 24** Explain how each of the following factors may be used to produce evidence supporting the Darwin–Wallace theory of evolution. Give ONE example in each of your answers for parts (a), (b) and (c) below.
- (a) Biochemical similarities
 - (b) Presence of homologous structures
 - (c) Age of the Earth
- 25** Name a non-infectious disease you have studied.
- (a) Describe a distinguishing sign or symptom of this disease.
 - (b) Is it possible to eradicate this disease from the human population? Explain your answer.
 - (c) What would be the effect on the human population if no attempt was made to control this disease?

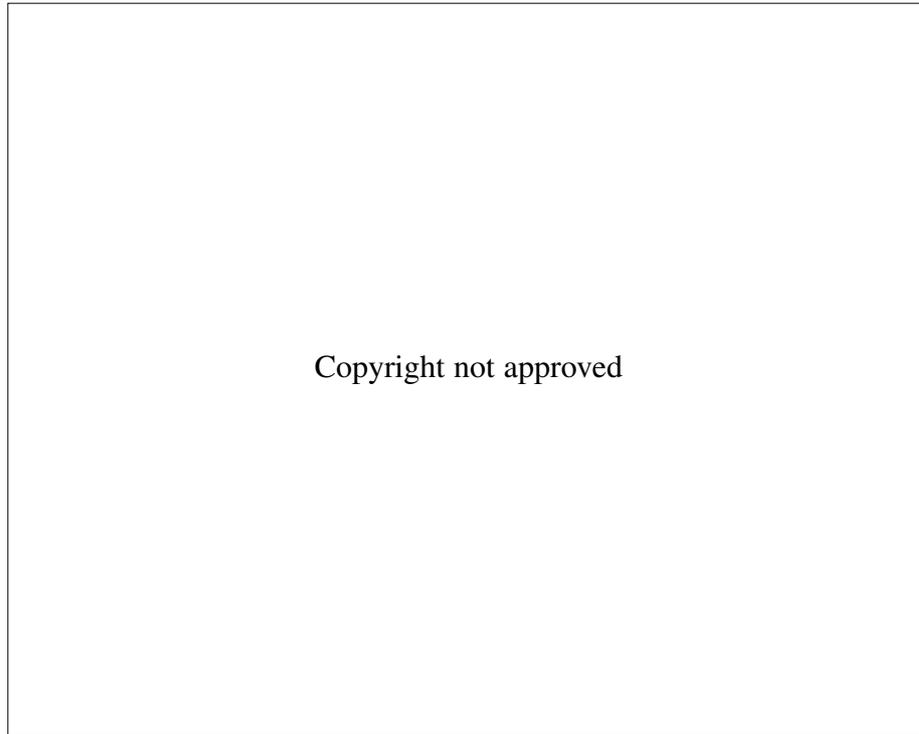
PART C

Questions 26–31 are worth 5 marks each.

Answer this Part in the Part C Answer Book.

- 26** (a) (i) Name a disease you have studied.
- (ii) Outline the historical development of the understanding of the causes of the disease named in part (a) (i).
- (b) (i) Name a macroscopic parasite whose life cycle can include a human host.
- (ii) Construct a diagram to show the life cycle of this parasite.
- (iii) Describe TWO features that assist it to survive as a parasite.
- (iv) Suggest ONE method for control of this parasite.

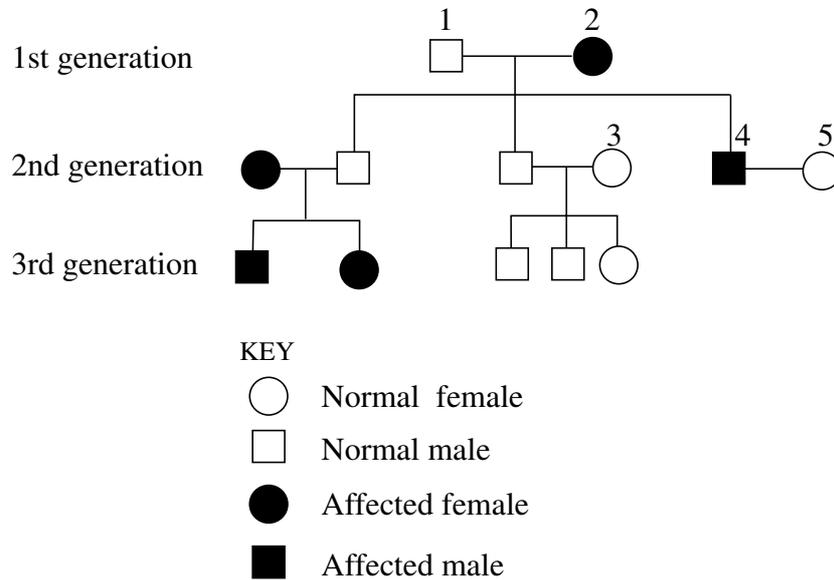
- 27** Metabolic rate is a term that can be used as an indicator of the rate at which animals use energy to maintain their body temperature. The graph shows the relationship between metabolic rate and body weight in endothermic animals.



- (a) Describe the relationship between body weight and metabolic rate as shown in the graph.
- (b) Explain the shape of the graph in terms of the surface area to volume ratio of endotherms.
- (c) Consider an ectotherm the same weight as a house mouse. Would its metabolic rate be higher, lower or the same as that of the house mouse? Explain.
- (d) Describe TWO ways in which ectotherms regulate their body temperature.

- 28** A particular disease is hereditary and is not sex-linked. The allele for the disease is dominant over the normal gene.

The pedigree below represents a family in which some members have the disease.



- (a) Show the genotype of individuals 1, 2, 3 and 4.
- (b) Predict the expected ratio of affected children produced by individuals 4 and 5. Show all working.
- (c) In another family the actual ratio of affected individuals is higher than predicted. Give ONE possible reason for this.
- (d) The disease still exists in the population even though it is eventually fatal. Suggest a reason for this.

29 The diagrams below show four organisms in cross-section.

These organisms have NOT been drawn to scale.

Organism *C* has no specialised respiratory surfaces, while *A* and *B* have gills and *D* has lungs.

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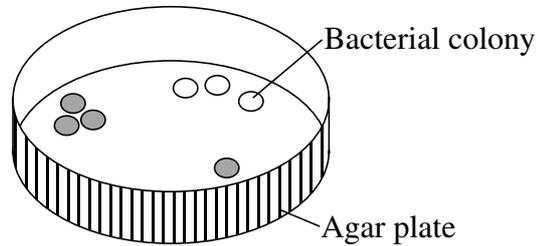
- (a) Why is it not necessary for organism *C* to have a specialised respiratory surface?
 - (b) What is the advantage of the folded respiratory surfaces in organisms *A*, *B* and *D*?
 - (c) Name TWO other features of mammalian respiratory systems and explain how these enable mammals to survive in a terrestrial environment.
 - (d) Name TWO disadvantages of the external gills of organism *B*.
- 30**
- (a) Draw a series of diagrams to show how the process of crossing over occurs during meiosis.
 - (b) Describe how the process of fertilisation leads to variation in a population.
 - (c) Komodo dragons are large lizards found in Indonesia but not in the rest of the world.
Describe a possible mechanism of evolution that could have caused this distribution.

- 31 Blood from an organism with a bacterial disease was diluted and smeared onto a nutrient-rich agar plate. Two different species of bacteria grew on the plate as shown in the figure.

Type of bacterial colony

○ Bacteria A

● Bacteria B



- (a) How could you use Koch's postulates to identify the bacterium responsible for the disease?
- (b) Blood from another organism with the same infection was diluted and smeared onto a similar plate. Predict whether the types of bacterial colonies are the same. Explain your answer.
- (c) Small protein molecules called prions are thought to cause bovine spongiform encephalopathy (*mad-cow disease*). Explain why it would be difficult to use Koch's postulates to identify the cause of mad-cow disease.

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	22–25
QUESTION 33 Structure and Function of Cells and Tissues	26–27
QUESTION 34 Control and Coordination	28–30
QUESTION 35 Classification and the Species Concept	31–34
QUESTION 36 The Human Species	35–37
QUESTION 37 Genes in Action	38–40
QUESTION 38 Human Environmental Impact.....	41–43

QUESTION 32 The Australian Environment**Marks**

- (a) The western-barred bandicoot (a small native mammal) used to be found over a large area of south-western Australia. Over the past 100 years, however, the bandicoot has become nearly extinct except for small populations on islands off the coast of Western Australia. **2**

Explain in detail TWO human activities that could assist in the reintroduction of the western-barred bandicoot onto the Australian mainland.

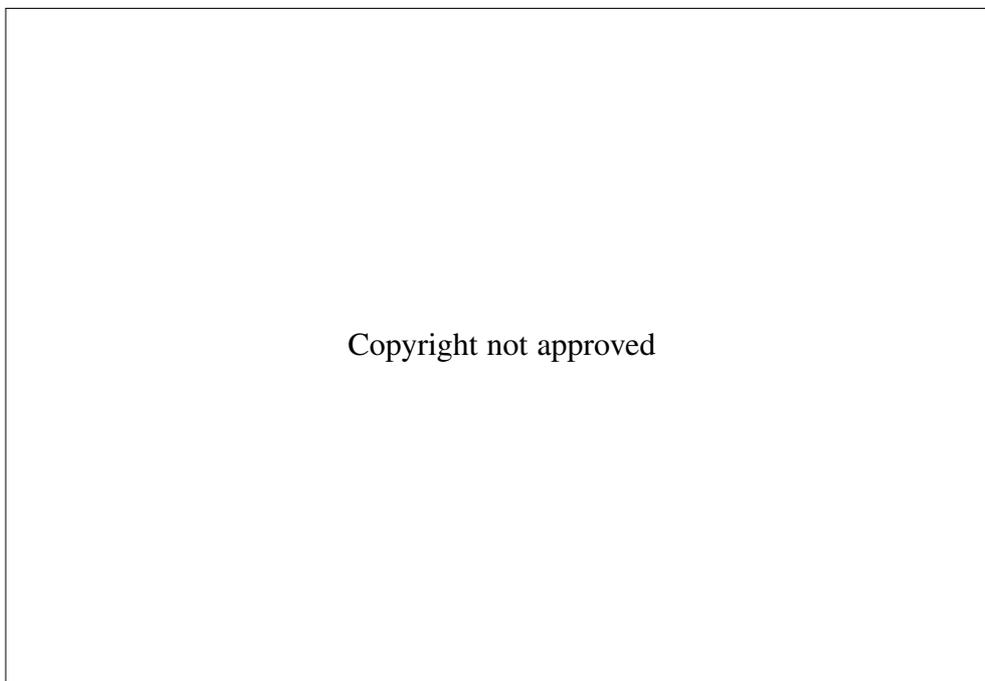
- (b) (i) Name the ecosystem you studied in this elective. **6**
- (ii) Describe the patterns of distribution and abundance of TWO named organisms in the ecosystem.
- (iii) Describe ONE method you used to determine the distribution and abundance of EACH organism named in part (b) (ii).
- (iv) Environmental components affect the distribution and abundance of organisms in ecosystems. State TWO environmental components you would measure in this ecosystem.
- (v) For ONE of the environmental components you have measured, explain how it could determine the distribution and abundance of the organism you studied.
- (vi) Describe an experiment you could do to test whether this environmental component has an effect on the distribution and abundance of the organism.
- (c) Select TWO stages in the life cycle of an animal you have studied. Discuss how TWO abiotic components influence EACH stage. You may select different abiotic components for each stage. **3**

Question 32 continues on page 23

QUESTION 32 (Continued)

Marks

- (d) A biologist wanted to find out how many animals of a particular species could be found in an intertidal area. The map shows the extent of the intertidal area. The biologist counted the number of the species of animal in the intertidal area by using a 1×1 m square placed in five different parts of the intertidal area. 4



1×1 m square	1	2	3	4	5	average
Number of animals	40	5	38	62	55	40

- (i) The sampling technique used by this biologist has a specific name. State the name of the technique.
- (ii) What is ONE advantage of this method of estimating the number of a particular species in the intertidal area.
- (iii) Discuss TWO problems with the method of sampling.
- (iv) Explain why the technique of capture–recapture was not appropriate for use in this study.

Question 32 continues on page 24

QUESTION 32 (Continued)

Marks

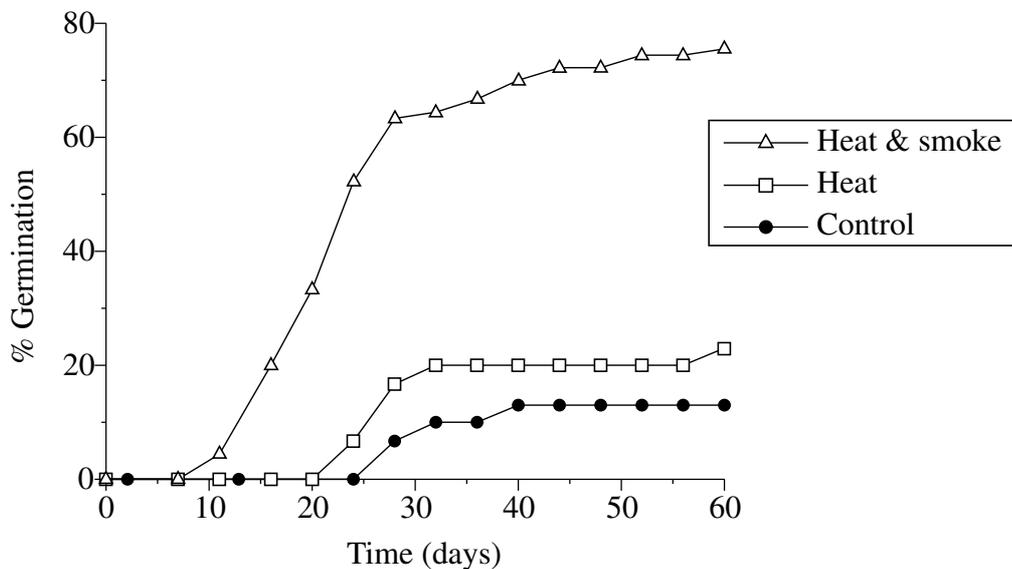
- (e) Often much time is given to the control of introduced animal and plant populations. 4

- (i) Name ONE introduced plant and ONE introduced animal species you have studied.
- (ii) Describe how EACH of these introduced plant and animal species can affect its food web in an ecosystem.
- (iii) Select EITHER the introduced animal OR the plant species.

If the number of this species was rapidly reduced, predict an effect on the environment. Explain your answer.

- (f) An experiment was performed to investigate the germination of seeds of *Grevillea linearifolia* in the family Myrtaceae. The first batch of seeds was heated and exposed to smoke. The second batch of seeds was exposed to heat but not smoke. The third batch of seeds was not exposed to heat or smoke. 3

The graph shows the percentage of seeds that germinated over a sixty-day period.



- (i) From the data shown above, describe ONE human activity that could change the germination of seeds of this plant in its environment. Explain your answer.
- (ii) Explain how the climate AND topography have affected the present distribution of a NAMED indigenous Australian plant from the Myrtaceae or Proteaceae families.

Question 32 continues on page 25

QUESTION 32 (Continued)

Marks

- (g) The evolutionary relationship of three genera of insects has a geographic pattern. The South American genus is more closely related to the Australian genus than is the older New Zealand genus. **3**

What TWO factors may have led to this present distribution? Use evidence to explain your answer.

End of question

QUESTION 33 Structure and Function of Cells and Tissues	Marks
(a) The processes by which carbon dioxide is fixed are often called the <i>Dark Reaction</i> . Why then is light important for carbon dioxide fixation?	2
(b) (i) What is the function of the following biochemical processes? 1 Krebs cycle 2 Cytochrome chain (ii) Red blood cells contain no mitochondria. Suggest how it is possible for red blood cells to extract energy from glucose.	3
(c) Draw a model to explain how enzymes work. Using your model, explain why: (i) different enzymes are specific for different substrates; (ii) enzyme catalysed reactions are reversible; (iii) high temperatures destroy enzyme activity; (iv) enzymes are not consumed by the reactions they catalyse.	5
(d) Name ONE specialised plant cell and ONE specialised animal cell that you have studied. (i) Describe TWO features they have in common. (ii) Describe ONE feature of each cell, other than those in part (d) (i), they share with other cells in the same organism. (iii) Describe ONE feature that enables each cell to perform its specific function.	3
(e) Describe ONE specialised feature of a unicellular organism and relate this feature to its function.	2

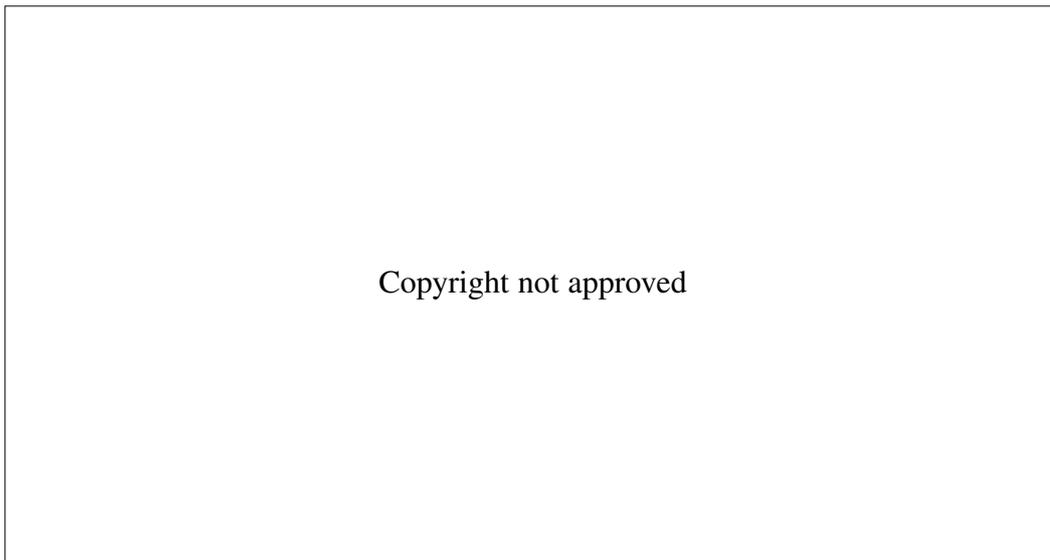
Question 33 continues on page 27

QUESTION 33 (Continued)

Marks

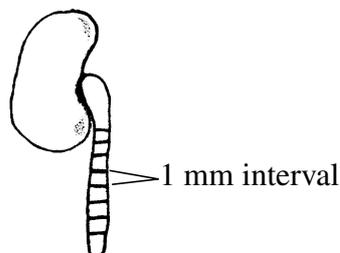
(f)

7



- (i) Name each organelle in the photograph.
- (ii) Using the photograph, draw a simple diagram showing the main features of each of the two organelles. Label **THREE** structures on each organelle.
- (iii) Name **ONE** cell where you would expect to find **BOTH** these organelles.
- (iv) Both organelles produce molecules that can be used by the other. Name **ONE** such molecule produced by:
- 1 organelle *A*;
 - 2 organelle *B*.
- (g) The diagram shows a newly emerged root. The emerging root has been marked at 1 mm intervals. Use a diagram to predict the appearance of the root and the markings after several days of further growth. Explain your prediction.

3



End of question

QUESTION 34 Control and Coordination**Marks**

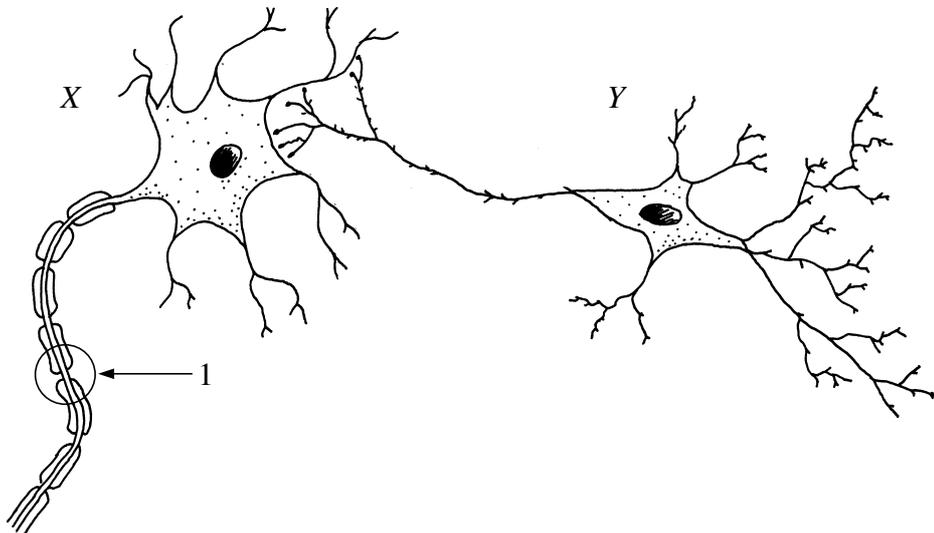
- (a) Control and coordination in animals is the result of the nervous and endocrine systems interacting to achieve homeostasis. **3**
- (i) What is meant by the term *homeostasis*?
 - (ii) Why can the nervous system respond to maintain homeostasis in less than a second whereas the endocrine system responds much more slowly?
 - (iii) Give ONE example of a response, or activity, that is controlled by BOTH the nervous and the endocrine systems. Describe the effect of each system on this response or activity.
- (b) While walking, a person steps on a sharp nail and responds rapidly by lifting their foot. Using a flowchart or diagram, detail the components involved in this simple reflex arc. **3**
- (c) **6**
- (i) Name ONE pituitary hormone and its target organ or gland.
 - (ii) Describe ONE effect of the hormone on the target organ or gland.
 - (iii) Using a diagram, explain how feedback controls the secretion rate of this hormone.
 - (iv) Outline the difference between positive and negative feedback control.
 - (v) If the activity of a target organ or gland responds poorly to a hormone, predict what will happen to the circulating levels of that hormone. Explain your answer.

Question 34 continues on page 29

QUESTION 34 (Continued)

Marks

- (d) The diagram shows two types of neurones that are adjacent to each other in the nervous system. 4



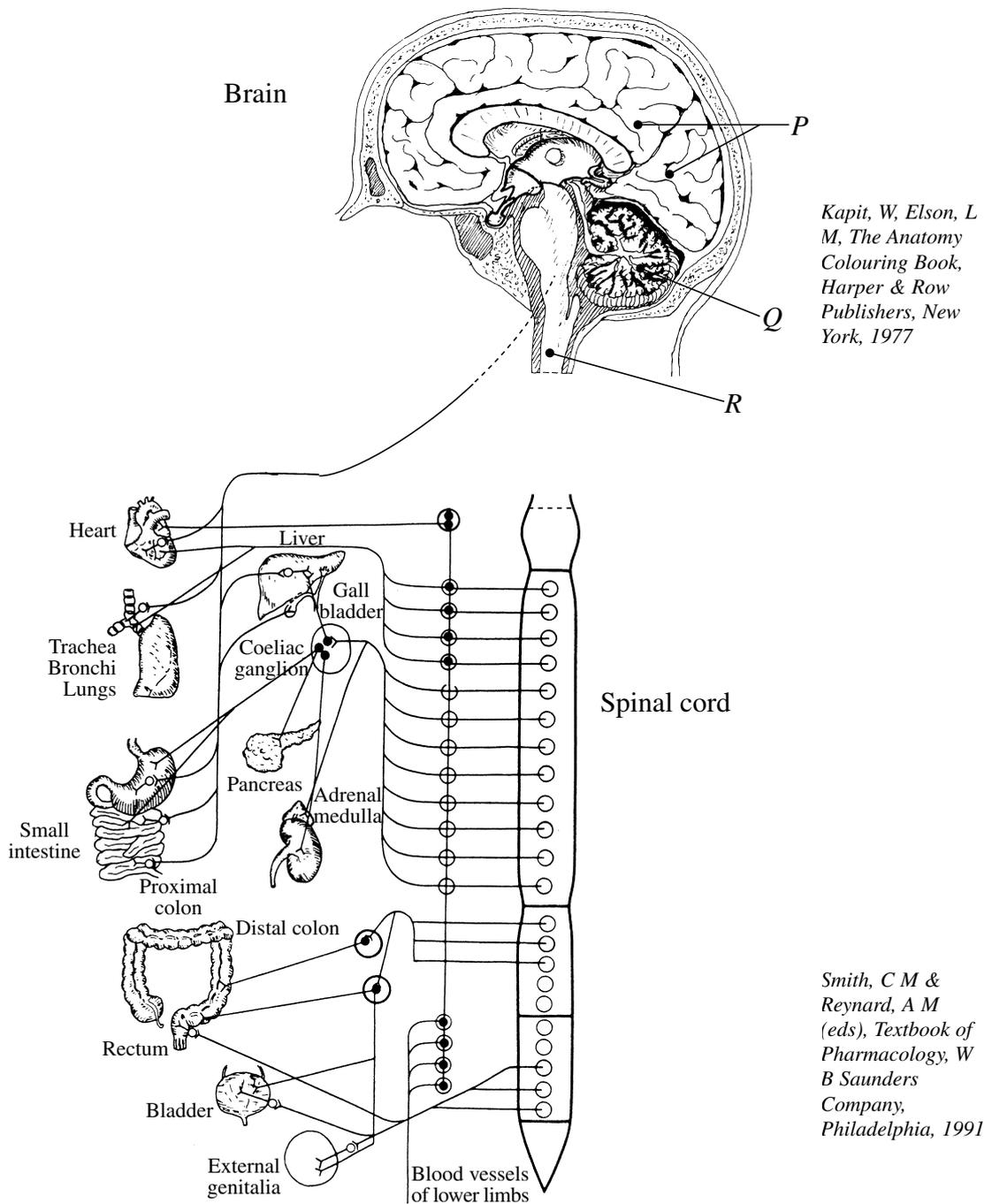
- (i) Name the types of neurone labelled *X* and *Y*.
- (ii) State the function of EACH neurone.
- (iii) Describe the method of nervous transmission shown:
- 1 in the circle labelled 1;
 - 2 between neurone *X* and *Y*.
- (iv) Would an action potential (nerve impulse) in neurone *X* normally initiate an action potential in *Y*? Explain your answer.
- (e) Numerous plant functions are controlled by hormones. 5
- (i) Name TWO plant hormones.
- (ii) For each hormone:
- 1 describe a stimulus that would increase its production or release;
 - 2 name the major target site in the plant;
 - 3 describe the process it is thought to control;
 - 4 state when, in the life of the plant, the concentrations of hormones are highest.
- (iii) Why do human hormones generally NOT affect the function of plants?

QUESTION 34 (Continued)

Marks

(f) The diagram shows various parts of the human nervous system.

4

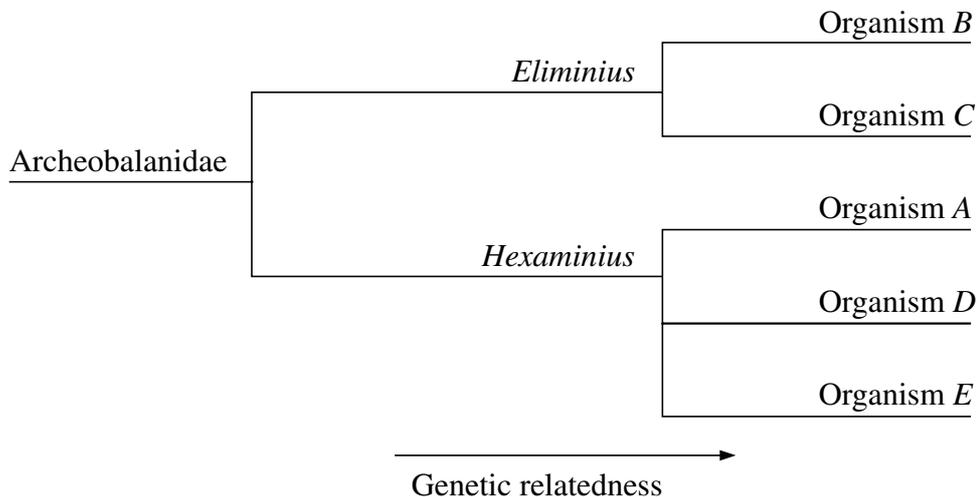


- (i) Name the structures labelled *P*, *Q* and *R* and state ONE function of each.
- (ii) In the diagram above, to which part of the nervous system do the nerve fibres exiting the brain and spinal cord belong?

End of question

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

- (a) When botanists arrived in Australia in the late-eighteenth century, they found many plants to classify. **4**
- List FOUR distinguishing features of these plants that botanists could have used to classify them.
 - Name TWO features that botanists would NOT have used to classify these plants. Justify your answer.
- (b) A biologist discovered two species of animals that resembled each other, one in New Zealand and the other in Australia. Organism *A* was given the specific name 'pope'. Organism *B* was given the specific name 'covert'. Later, species *C*, *D* and *E* were found. The relationships between the species are illustrated using the following diagram. **3**



- Give the binomial names for organism *A* and organism *B*.
 - Which organism is more closely related to organism *A*; organism *C* or organism *E*? Explain your answer.
 - What level of classification would you expect Archeobalanidae to represent.
- (c) Classification is an important tool used by biologists. **4**
- List in order the categories used. At which level are the organisms least alike?
 - What type of characteristics are used most often in classifying animals? Explain your answer using examples you have studied.

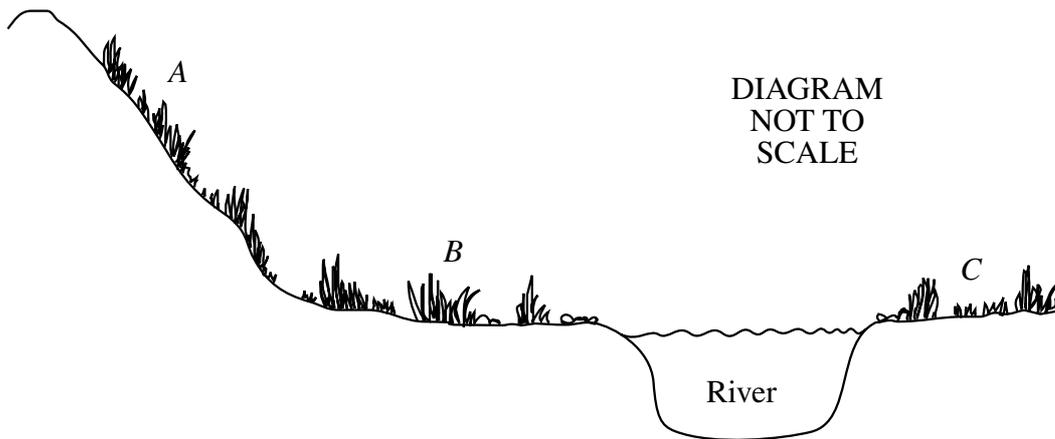
Question 35 continues on page 32

QUESTION 35 (Continued)

Marks

(d)

5



A species of lizard lives on a mountain slope (*A*) and on grassy plains (*B* and *C*). The plains are separated by a large river. After a substantial period of time the lizards at *C* have become a new species.

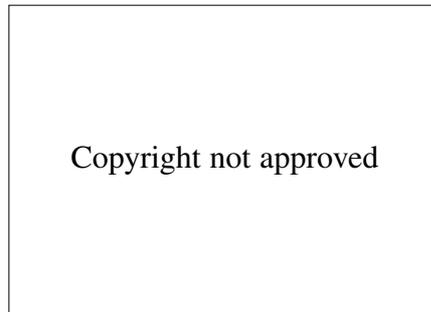
- (i) State THREE hypotheses that would account for this speciation.
- (ii) Explain in detail why populations *A* and *B* have not become separate species.

Question 35 continues on page 33

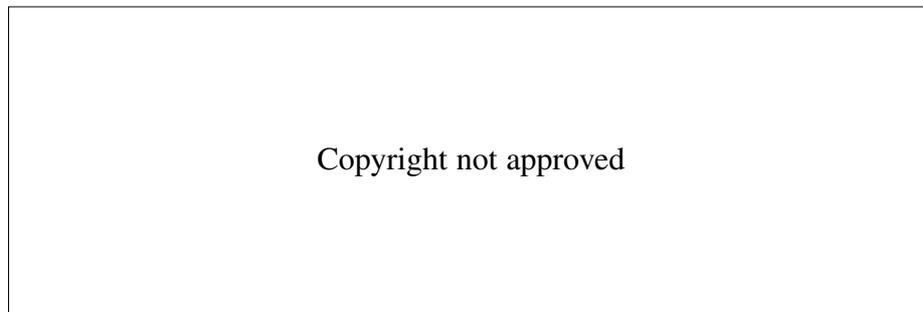
QUESTION 35. (Continued)

Marks

- (e) (i) Give TWO reasons why the organism below is NOT classified as an insect. 5

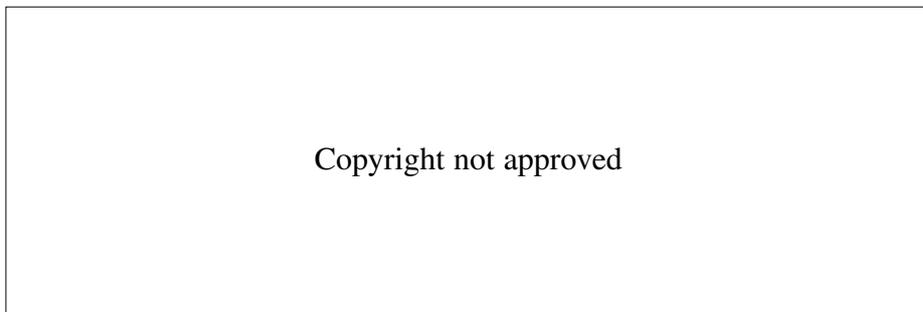


- (ii) The Order *Hymenoptera* contains insects such as bees, wasps and ants. The diagrams show four insects from this Order.



Insect A

Insect B



Insect C

Insect D

Using information supplied in the above diagrams, construct a dichotomous key to divide these organisms into different groups. The first step is provided below as a guide.

- 1a. Wings present go to 2
- 1b. Wings absent Insect A

- (iii) Name an insect Order, other than *Hymenoptera*, that you have studied.
- (iv) Describe ONE characteristic of this Order that distinguishes it from the Order *Hymenoptera*.

Question 35 continues on page 34

QUESTION 35 (Continued)

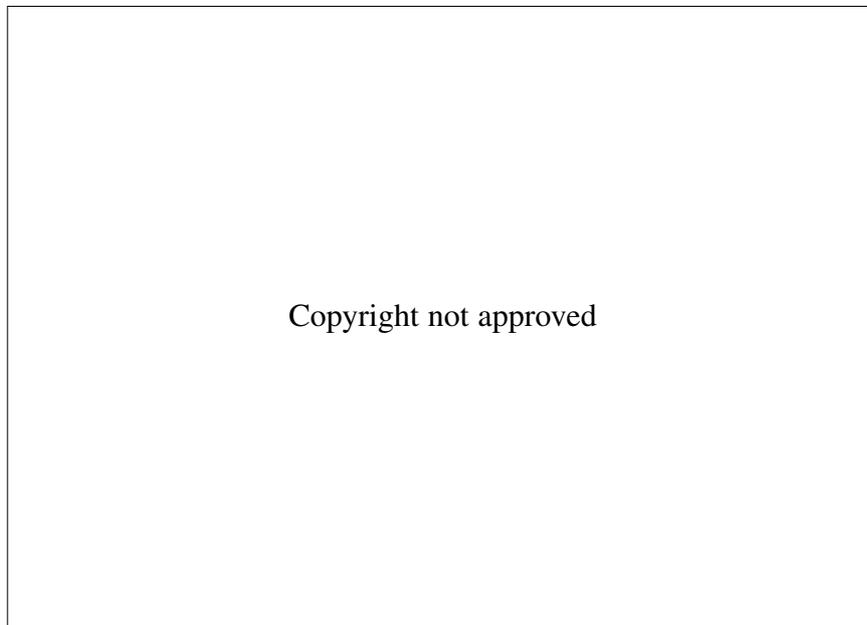
Marks

- (f) A new plant, *Melissia begonifolia*, was recently discovered on a British island. **2**
A fossil plant similar in appearance to *Melissia begonifolia* was also found twenty years ago on a nearby island.

A biologist stated: 'as the plants were found on different islands, it is very unlikely that they belong to the same species'.

Suggest ONE argument that would support this statement and ONE that would not support it.

- (g) The diagram shows a male and female blackbird, *Agelaius phoeniceus*. **2**
Early scientists originally classified the male and female as belonging to different species.

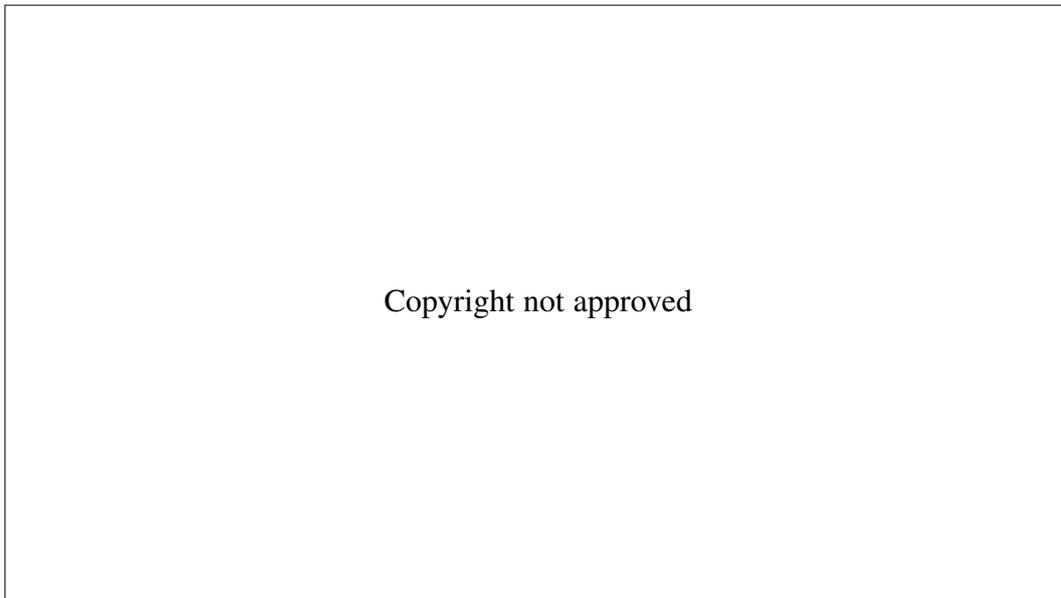


- (i) Why did this occur?
(ii) How was this problem overcome?

End of question

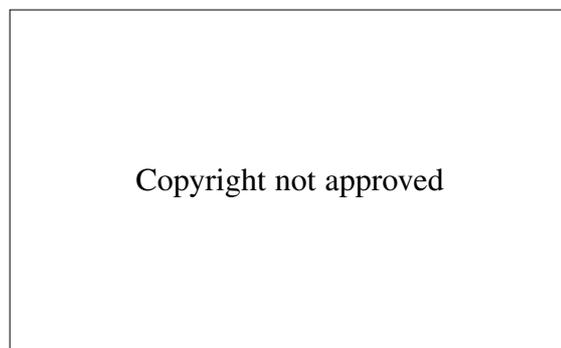
QUESTION 36 The Human Species**Marks**

- (a) The diagrams compare a human skeleton with that of an ape.

3

Explain how EACH set of diagrams shows an adaptation for bipedalism (striding upright gait) in humans.

- (b) Below is a diagram of a loris, a tree-dwelling primate.

3

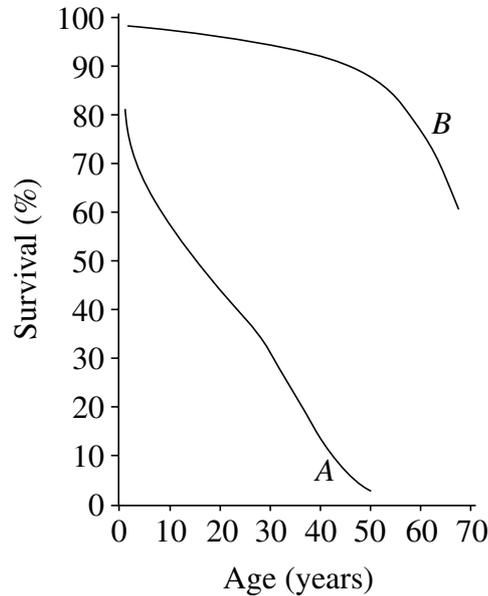
- (i) What **THREE** features would you expect it to possess in order to be classified as a mammal?
- (ii) What **THREE** features would you expect it to possess in order to be classified as a primate?

Question 36 continues on page 36

QUESTION 36 (Continued)

Marks

- (c) The graph shows survival patterns in a population (A) which existed 1000 years ago and in a modern human population (B) measured in 1960. 3



- (i) Compare the differences in survival rates at birth and between 30 and 60 years.
- (ii) Discuss TWO reasons for the shape of graph B.
- (d) A widely held belief is that in humans, the height to weight ratio decreases with the decrease of average environment temperature. 3
- (i) Explain how this could be an advantage for a specific human population.
- (ii) There are difficulties in sustaining the concept of *race*. Explain, using an example, why this is the case.
- (iii) Give TWO other characteristics that vary in *Homo sapiens* that may result in an adaptive advantage under different climatic conditions.

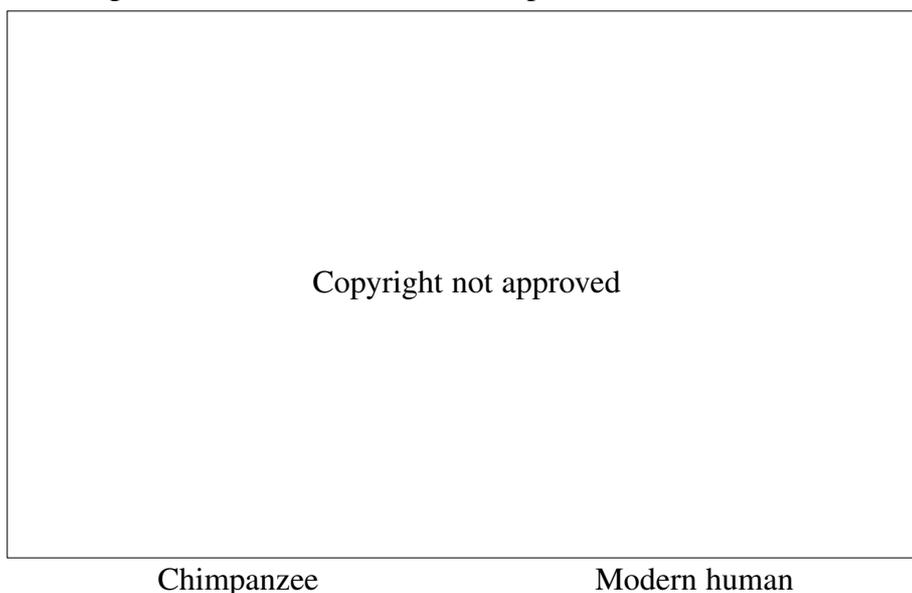
Question 36 continues on page 37

QUESTION 36 (Continued)

Marks

- (e) The diagrams show the hands of a chimpanzee and a human.

2



- (i) Identify ONE common feature and explain how this allows both species to use tools.
- (ii) Use the diagram to explain why humans are able to use more complex and durable tools.
- (f) It has been claimed that an intact fossil skull that has been discovered is that of a recent ancestor of modern humans.

3

Identify THREE characteristics of the skull that you would look for to justify this claim. Explain your answer.

- (g) Archaeological evidence provides clues to the lives of early hominids.
- (i) Give an example of a piece of archaeological evidence. What information may it provide about the hominids that lived at that time?
- (ii) There are limitations in relying on palaeontological and archaeological evidence alone for the interpretation of past cultures. Discuss ONE limitation evident when studying the Australian Aborigines.
- (h) (i) Compare the concepts of biological evolution and cultural development, giving ONE example of each.

4

4

- (ii) Give ONE example where cultural development has influenced biological evolution.

End of question

QUESTION 37 Genes in Action**Marks**

- (a) (i) It has been said that genes are ‘the chemical code for life’. Using diagrams, explain how this code is translated by living cells. Include the roles played by DNA, m-RNA, t-RNA and ribosomes. **4**
- (ii) A wide variety of characteristics are thought to be genetically controlled. If genes control protein synthesis, explain how this is possible.

- (b) A normal RNA sequence is shown below, together with different mutations. **4**

Normal AUG ACG CAG AAU UGG GAU CCU ACG

Mutation 1 AUG CCG CAG AAU UGG GAU CCU ACG

Mutation 2 AUG CGC AGA AUU GGG AUC CUA CGC

- (i) What types of mutations are represented by 1 and 2? Explain your answer.
- (ii) Describe ONE possible effect of EACH mutation on protein synthesis. Give reasons for your answers.
- (iii) Describe TWO possible causes of the above mutations.

Question 37 continues on page 39

QUESTION 37 (Continued)

Marks

- (c) The height of most adult humans is in a range from 125 cm to 215 cm. The heights of a population of adult humans were measured and the results are shown in the table. 2

<i>Height in cm</i>	<i>Number of adults</i>
145–149	3
150–154	12
155–159	38
160–164	118
165–169	275
170–174	301
175–179	260
180–184	155
185–189	53
190–194	17
195–199	2

If the environmental conditions for individuals in this group are similar, how could the range of differences be explained by the genetic make-up of the population?

- (d) (i) Name a condition in an organism that results from an abnormal change in the number of chromosomes. 2
- (ii) Describe the abnormality in chromosome number.
- (iii) What effect does this have on the organism?

Question 37 continues on page 40

QUESTION 37 (Continued)

Marks

- (e) Two babies *K* and *L* are born to different sets of parents. Baby *K* has blood group O and baby *L* has blood group A. 3

	BLOOD GROUP	
	<i>Mother</i>	<i>Father</i>
Couple 1	AB	O
Couple 2	B	B

Use the information above to match EACH baby with its correct set of parents. Show all working and give a full explanation.

- (f) Humans have used techniques of genetic manipulation for thousands of years. More recently, recombinant DNA techniques have become available. Describe TWO advantages and TWO disadvantages of recombinant DNA technology over traditional artificial selection techniques. 4
- (g) An individual is concerned about a genetic condition that occurs in their family. Outline the factual information a genetic counsellor would require in order to advise this person. 3
- (h) (i) What is a *chromosome map*? 3
- (ii) Explain how linkage can be used to construct chromosome maps.

End of question

QUESTION 38 Human Environmental Impact**Marks**

- (a) (i) The human population size was approximately 500 million at the beginning of the sixteenth century (AD 1500). **3**
- Sketch and label a graph demonstrating the changes in the human population size between 1500 and now.
- (ii) The change from a hunter-gatherer to an agricultural society affected the rate of growth of the human population. Give TWO reasons why this cultural change resulted in a marked increase in population growth.
- (b) (i) Name a resource you have studied that has been exploited or redistributed. **4**
- (ii) List ONE positive and ONE negative environmental effect that results from the continued use of this resource. Explain your answers.
- (iii) List ONE positive and ONE negative economic effect that results from the continued use of this resource. Explain your answers.
- (c) Urbanisation has led to many environmental modifications that impact on natural ecosystems. **3**
- (i) Name ONE form of environmental modification resulting from urbanisation that you have studied this year.
- (ii) Describe how this modification has directly or indirectly polluted the natural environment.
- (iii) Select ONE type of waste produced by urbanisation and describe its disposal.
- (iv) What effect does the disposal of this waste have on the natural environment?

Question 38 continues on page 42

QUESTION 38 (Continued)

Marks

- (d) The miniature pine, *Microstrobos fitzgeraldii*, is a prehistoric plant that grows only on rock ledges under four south-facing waterfalls in the Blue Mountains. It is being threatened by English Ivy which hangs in long curtains from the cliff-face, smothering the small pines. **4**
- (i) Explain why *Microstrobos fitzgeraldii* is considered to be an endangered species.
 - (ii) Outline TWO management plans to assist in the pine's survival.
 - (iii) English Ivy is an introduced species. Outline a possible chain of events that may have led to its successful colonisation of these cliff-faces in the Blue Mountains.
- (e) Agricultural enterprises produce numerous exports that add to Australia's wealth. However, some agricultural practices have a long term negative effect on the natural environment. **4**
- (i) Name TWO agricultural practices that exploit the environment in the short term and are not sustainable in the long term.
 - (ii) Give TWO reasons why these types of agricultural practices are not sustainable.
 - (iii) Suggest ONE modification to EACH of these practices that will improve its sustainability. Explain why this modification helps make the practice more sustainable.
- (f) Two adjacent lakes A and B, with similar ecosystems, are polluted by leakage of harmful substances. A major oil spill occurred in lake A. In lake B, radioactive waste material was leaked, initially resulting in the death of a small number of fish. **3**
- (i) How may EACH lake be affected ONE month after its pollution? Justify your answer.
 - (ii) What action should be taken to minimise the effects of each form of pollution on the natural ecosystems of each lake.
 - (iii) Which of these disasters has the potential to cause the greatest long-term damage to the lake? Explain your answer.

Question 38 continues on page 43

QUESTION 38 (Continued)

Marks

- (g) Controlled burning of bushland was a practice of some Aboriginal groups and is now practised by volunteer fire brigades. **4**
- (i) Compare the reasons for the use of controlled burning by each group.
 - (ii) Give TWO environmental advantages that controlled burning has in our modern society.
 - (iii) Give TWO possible disadvantages that may result from this practice.

End of paper

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