

BOARD OF STUDIES
NEW SOUTH WALES

HIGHER SCHOOL CERTIFICATE EXAMINATION

2000
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.

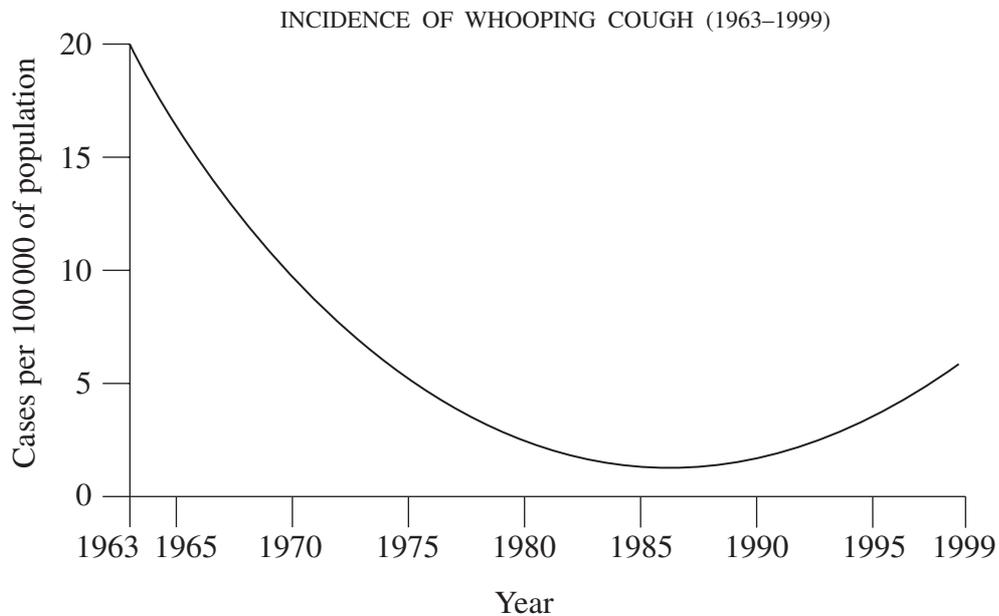
Section II—Electives

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

- 1 Both ectothermic and endothermic terrestrial animals have a variety of ways to deal with variations in environmental temperature. Which of the following correctly identifies *physiological* adaptations to environmental temperature conditions?

	<i>Ectothermic animal</i>	<i>Endothermic animal</i>
(A)	Sunbaking	Panting
(B)	Dilation of blood vessels in the skin	Shivering
(C)	Burrowing	Sweating
(D)	Redirection of blood away from the extremities	Large ear size

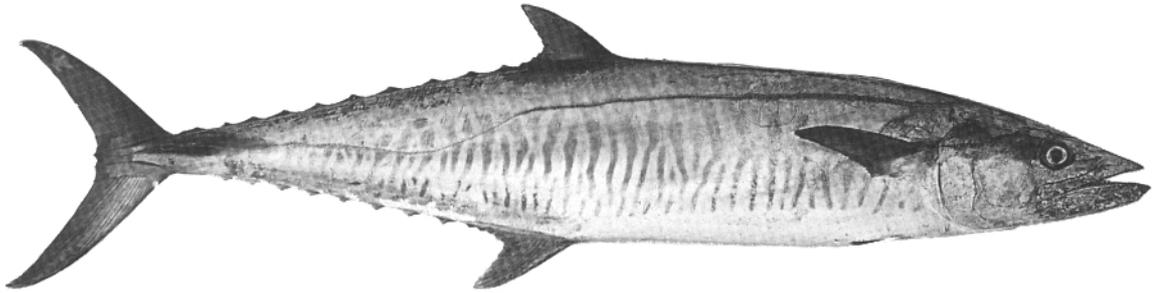
- 2 The graph shows the incidence of whooping cough in a population. A vaccine for whooping cough was introduced in 1963, but concerns about the side effects have led to fewer people being given the vaccine over the last 15–20 years.



What conclusion can be made from the graph?

- (A) The incidence of whooping cough before 1963 was greater than 20 cases per 100 000.
- (B) The benefits of using the vaccine outweigh the side effects.
- (C) The incidence of whooping cough will increase over the next 10 years.
- (D) The vaccine did not eradicate whooping cough from the population.

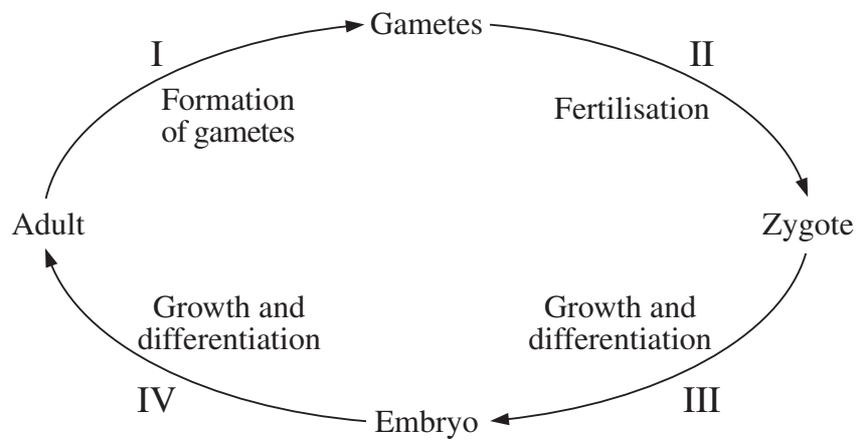
- 3 The diagram shows a Queensland school mackerel (*Scomberomorus queenslandicus*).



Covacevich J, Davie, P and Pearn, J Toxic Plants and Animals: A Guide for Australia, Brisbane, Queensland Museum, 1987.

The overall body shape of the mackerel is a *structural* adaptation to which one of the following abiotic factors of the marine environment?

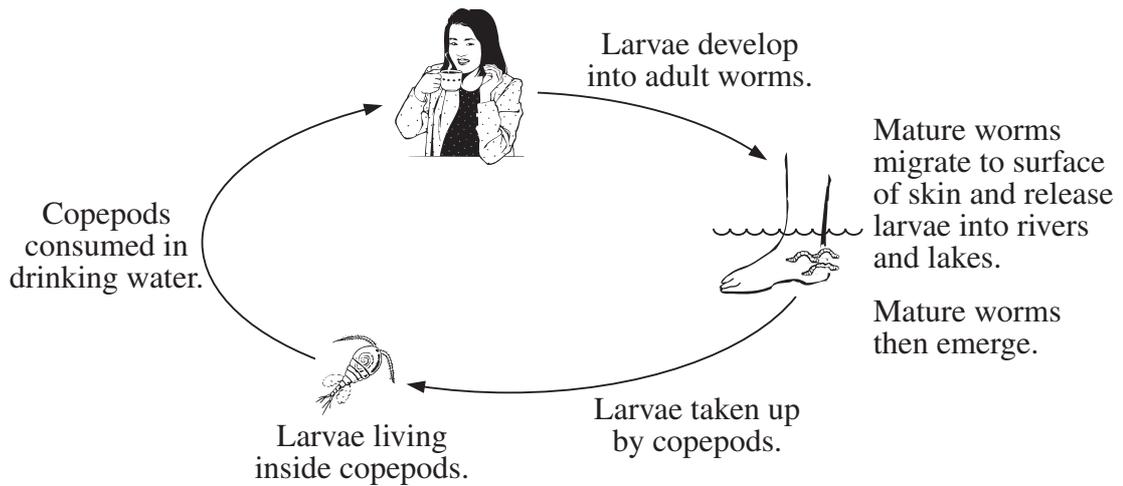
- (A) High viscosity
 - (B) High pressure
 - (C) Low temperature
 - (D) Low buoyancy
- 4 Below is the life cycle of a mammal.



Which process(es) causes the variation in the genotype of the offspring?

- (A) I only
- (B) I and II
- (C) III and IV
- (D) IV only

- 5 What is the role of T-cells in the human immune response?
- (A) They engulf invading pathogens.
 (B) They produce antibodies.
 (C) They produce mucus.
 (D) They release chemicals that kill cells.
- 6 The Guinea worm has the following life cycle.



What control measure would NOT be appropriate?

- (A) Filtering of drinking water to remove copepods
 (B) Preventing infected individuals from swimming in reservoirs
 (C) Killing mature worms after their emergence
 (D) Giving drugs to prevent the maturation of larvae in humans

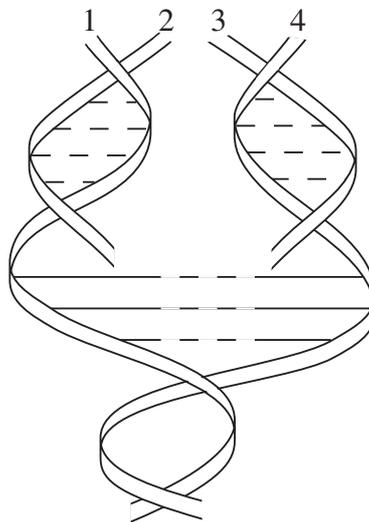
- 7 The table summarises the maximum and minimum temperatures for three different environments in Australia.

	<i>Environment 1</i>		<i>Environment 2</i>		<i>Environment 3</i>	
Month	Max (°C)	Min (°C)	Max (°C)	Min (°C)	Max (°C)	Min (°C)
January	19	17	24	15	35	19
July	15	13	18	9	22	8

One environment is terrestrial, one is marine, and the other is a small pond. Which of the following correctly identifies each environment?

	<i>Environment 1</i>	<i>Environment 2</i>	<i>Environment 3</i>
(A)	Marine	Terrestrial	Small pond
(B)	Small pond	Marine	Terrestrial
(C)	Marine	Small pond	Terrestrial
(D)	Terrestrial	Small pond	Marine

- 8 The diagram shows a section of DNA undergoing replication.



*Mader, S. Inquiry into Life, Dubuque, Iowa:
W C Brown, 1994 © The McGraw-Hill Companies*

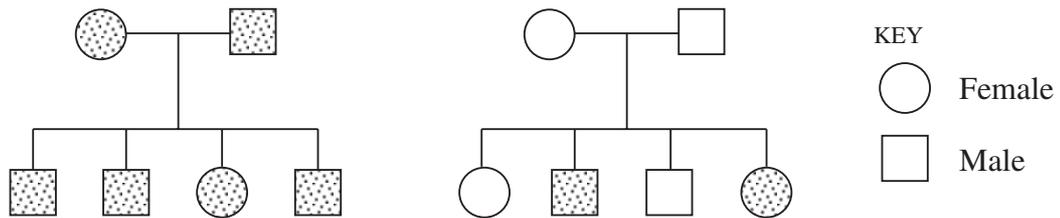
In which two strands of DNA would the sequence of bases be the same?

- (A) 1 and 4
 (B) 2 and 3
 (C) 3 and 4
 (D) 2 and 4

- 9 A deep ocean probe has been developed that can monitor abiotic factors of the marine environment. If the probe was dropped to the bottom of the ocean and turned on, which of the following trends would be observed in the abiotic factors as the probe was raised?

ABIOTIC FACTOR			
<i>Oxygen concentration</i>	<i>Carbon dioxide concentration</i>	<i>Pressure</i>	<i>Light</i>
(A) Decrease	Decrease	Decrease	Increase
(B) Increase	Increase	Increase	Decrease
(C) Increase	Decrease	Decrease	Decrease
(D) Increase	Increase	Decrease	Increase

10



The diagram shows the pattern of inheritance of a coat colour gene in cats. Individuals represented by shaded symbols show the coat colour.

Which of the following statements best describes the inheritance of this coat colour?

- (A) It is a recessive allele.
 (B) It is a sex-linked allele.
 (C) It is a dominant allele.
 (D) It is an incompletely dominant allele.

- 11** Snake venom contains toxic proteins. Antivenoms are produced from the blood of horses that have been injected with low doses of the snake venom.

Humans who have been bitten by venomous snakes can be treated using these antivenoms.

Which of the following provides the best explanation of the way antivenoms function?

- (A) They stimulate the human immune system to produce antibodies to the snake venom.
 - (B) They provide T-cells against the snake venom.
 - (C) They provide snake venom antigens.
 - (D) They provide molecules that will bind with the venom protein.
- 12** A recent study reported that babies born to undernourished mothers were relatively small. When these babies matured and gave birth to their own children, their offspring were also found to be small, even though the mothers were well nourished.

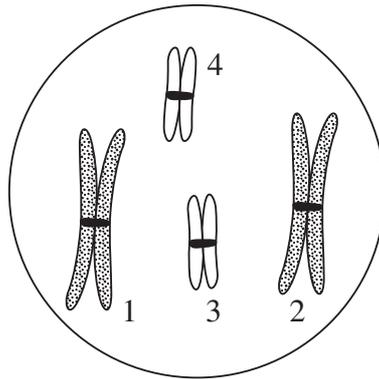
This finding would have best supported the theory of evolution of which of the following biologists?

- (A) Darwin
 - (B) Lamarck
 - (C) Mendel
 - (D) Wallace
- 13** It is suspected that a specific virus is responsible for a non-fatal human disease. The virus cannot be grown using artificial nutrient media, but it can be grown in cultured human cells. The virus cannot be isolated from other human viruses.

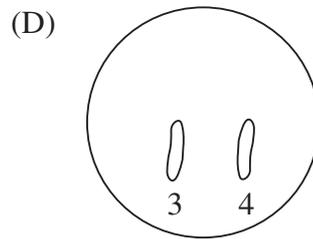
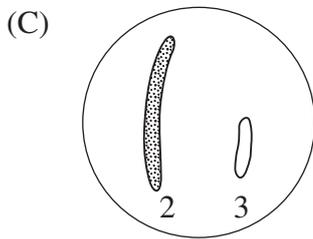
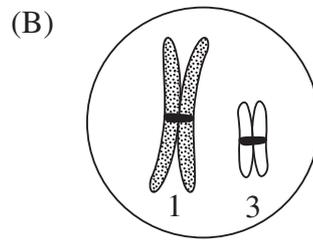
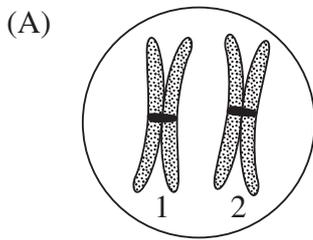
Which of the following factors would make it impossible to use Koch's postulates to prove that the virus was responsible for the disease?

- (A) The difficulty in isolating the virus from other viruses
- (B) The inability to grow the virus using artificial nutrient media
- (C) Koch's postulates apply only to bacteria
- (D) The fact that the disease is non-fatal

- 14 The diagram shows a parent cell with four chromosomes at an early stage of meiosis.



Which of the following cells is most likely to be produced at the end of the first meiotic division?



- 15 A biologist discovers two populations of the same species of Huntsman spiders. Members of one population are found in leaf litter in the middle of a wet sclerophyll forest. Members of the other population are slightly lighter in colour and are found in the grass at the edge of the forest.

What is the best explanation for the differences between the two adult populations?

- (A) The two populations have not been able to interbreed and individuals are changing to suit their environment.
- (B) The differences in the environments have changed the physical appearance of the spiders.
- (C) Certain characteristics of the spiders were more suited to the particular environmental conditions and, over successive generations, the characteristics became more common.
- (D) The two populations of spiders were originally two different species.

PART B

Questions 16–25 are worth 3 marks each.

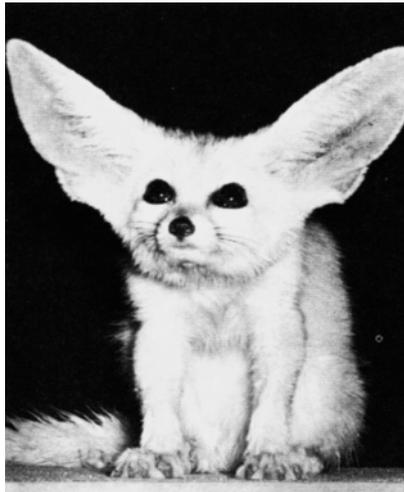
Answer this Part in the Part B Answer Book.

16 In his book '*The Origin of Species*', Charles Darwin wrote

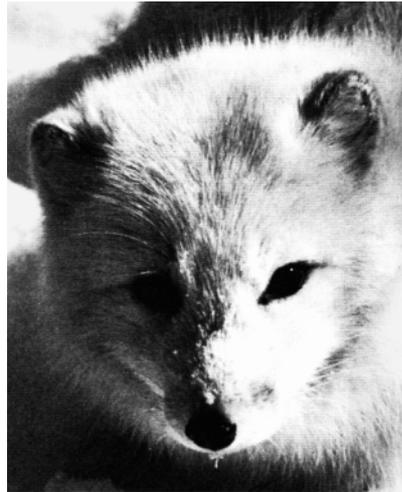
'What can be more curious than that the hand of a man, formed for grasping, that of a mole for digging, the leg of a horse, the paddle of the porpoise, and the wing of the bat should all be constructed on the same pattern, and should include similar bones in the same relative positions?'

- (a) Modern biologists call these homologous structures. How do homologous structures provide evidence to support the theory of evolution?
- (b) Give ONE example of a transitional form and explain how it can be used to support Darwin's theory of evolution.

17



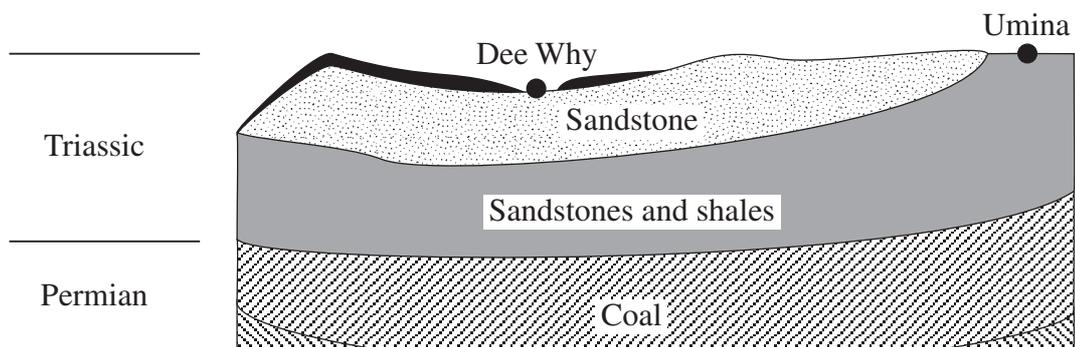
FENNEC FOX



ARCTIC FOX

- (a) The Fennec fox of the hot North African desert region has large thin ears. The Arctic fox has small stubby ears. Explain ONE possible advantage of the difference in ear size in the particular environment of each fox.
- (b) Besides ear shape and ear size, name ONE structural and ONE behavioural adaptation of animals that inhabit cold climates. Explain how each of these adaptations provides an advantage to the organism.

- 18** A gardener sows 100 seeds of a plant species in a single garden bed. While the plants are growing, the gardener notices that a group of 15 plants in one part of the garden bed is not growing as tall as the rest of the plants. There is no dwarf form of this plant species.
- Name ONE factor that may have caused the difference in the size of the two groups of plants.
 - Design an experiment that the gardener could carry out to determine whether the factor you named is responsible for the reduced size.
- 19**
- Name ONE example of a malfunction of the human immune system that causes a specific disease.
 - How does the malfunction cause the signs or symptoms of the disease?
 - A graft is tissue that has been transplanted from one site to another. A graft may or may not survive in the body. Two ways grafts are transferred are:
 - autograft — tissue transferred to another site on the same body;
 - allograft — tissue transferred to a genetically different organism of the same species.
 - What differences, if any, would you expect there to be in the body's response to these two types of grafts? Explain your answer.
 - What effect could a malfunction of the immune system have on the body's response to a graft? Explain your answer.
- 20** Fossils have been found in rocks near the surface at Dee Why and Umina, NSW. The diagram is a cross-section of the rocks that underlie these areas.

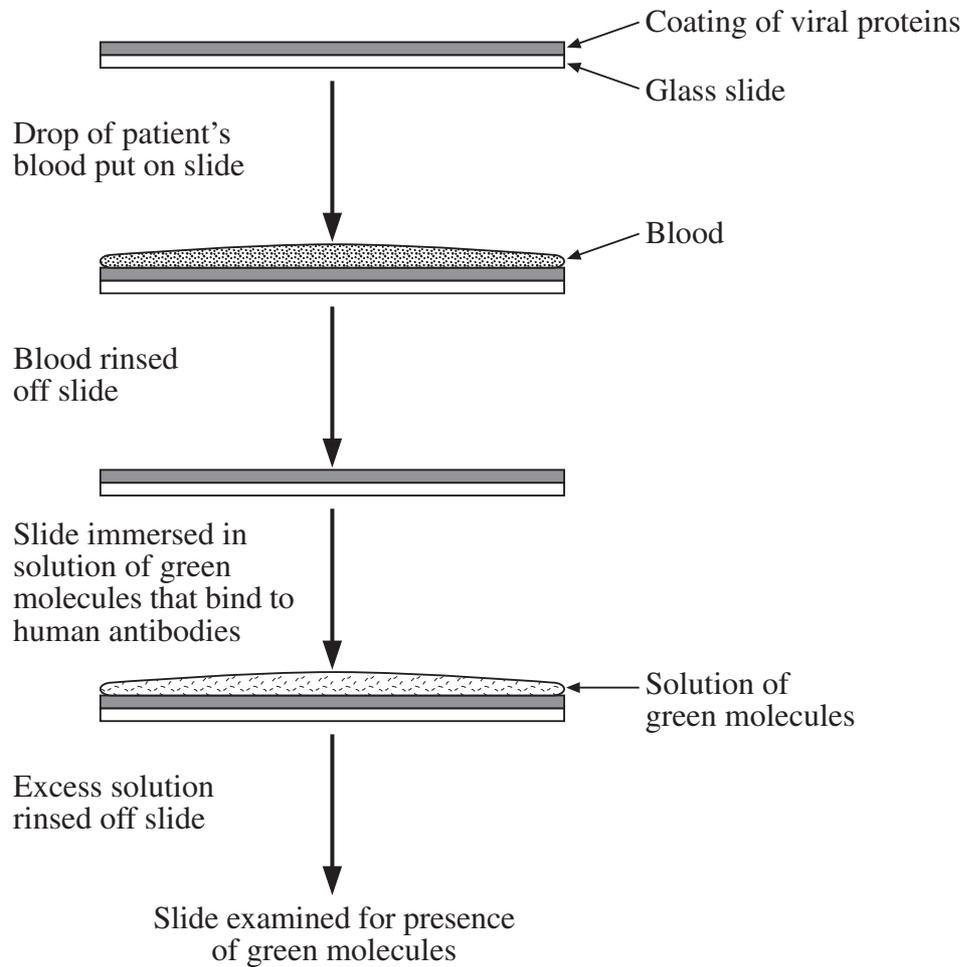


Williams & Gregory, Clearway Biology: HSC exam questions with answers and worked solution, Sydney, McGraw-Hill, 1987

- Would you expect the rocks in which the fossils were found to be the same age, or is one rock significantly older than the other? Explain your answer.
- How is a study of fossils used to provide evidence for biological evolution?

- 21 Proteins isolated from mumps virus were attached to the surface of a glass slide to form a permanent thin film.

A sample of blood from a patient suspected of having mumps was smeared onto the film. The blood was rinsed off the slide, and the slide was then immersed in a solution of green molecules that bind to ANY human antibodies. The slide was then rinsed with water.



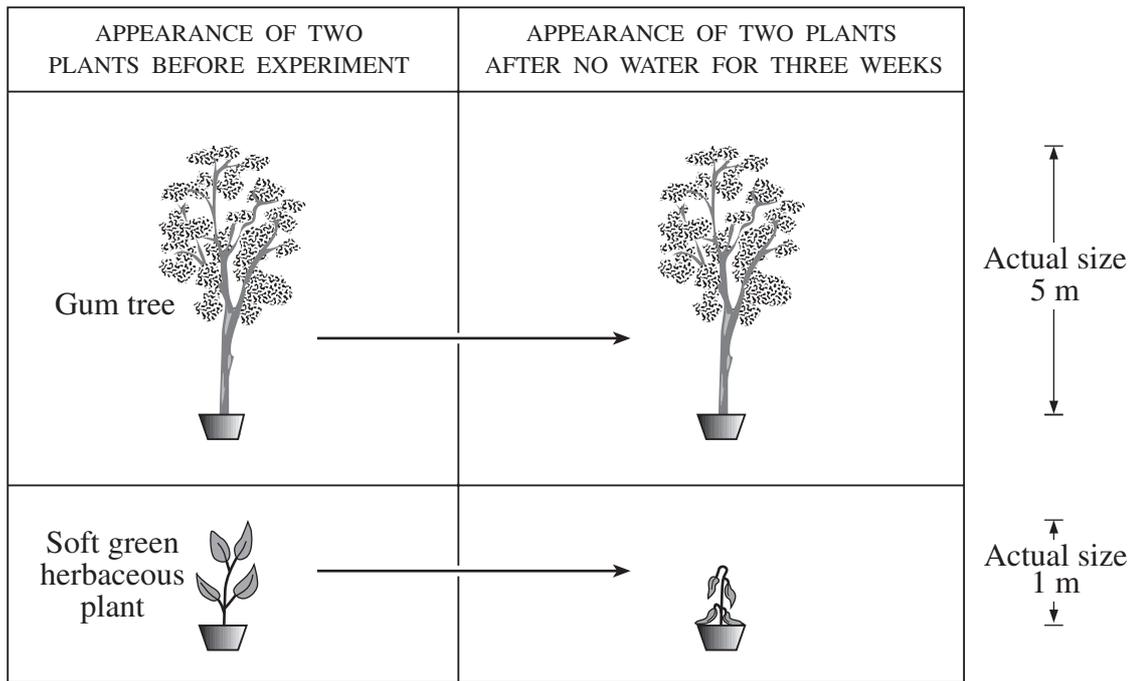
- (a) How does this test determine if the patient has mumps?
- (b) Why is the test specific for mumps?
- (c) Why does the slide have to be rinsed:
- after the addition of blood?
 - after it has been immersed in the solution of green molecules?

- 22** The table shows the recommended program of vaccinations for various human diseases.

<i>Disease</i>	IMMUNISATION	
	<i>Initial treatment</i>	<i>Follow-up treatment (booster)</i>
Diphtheria, tetanus, whooping cough	4 injections at 2, 4, 6, 18 months	5 years
Poliomyelitis	3 oral doses at 2, 4, 6 months	5 years, 15 years
Rubella	Injection at 12 years	Before considering pregnancy

- (a) Define *immunisation*.
- (b) Why are multiple doses and boosters needed for some, but not all, of these diseases?
- (c) Can all infectious diseases be prevented by vaccination? Explain your answer.
- 23** (a) Urination is one way that water may be lost from the body of a mammal. Apart from urination, state TWO ways in which water may be lost from the body of a mammal.
- (b) For EACH answer in part (a) describe ONE way in which desert mammals minimise water loss.

- 24** The following diagram shows the results of a simple investigation into the effects of the lack of water on two different types of terrestrial plant.



Brown, Lisle, Dynamic Agriculture Book 1, Sydney, McGraw-Hill, 1998

- (a) Explain why the lack of water produced the above effect on the herbaceous plant, but had little effect on the gum tree.
- (b) Draw a typical photosynthetic cell for the herbaceous plant before and after the experiment. Label your diagram, and indicate any differences between the 'before' and 'after' diagrams.
- 25** (a) Draw THREE labelled diagrams to show the events before, during and after the crossing over of chromosomes during meiosis.
- (b) Usually, crossing over does not occur during mitosis. Why?

PART C

Questions 26–31 are worth 5 marks each.

Answer this Part in the Part C Answer Book.

- 26** When Gregor Mendel studied the inheritance of characteristics in pea plants, he discovered that the round seed shape was dominant over the wrinkled seed shape and that yellow seed colour was dominant over green seed colour.

In a biology experiment, you cross pure breeding round yellow seed plants with pure breeding wrinkled green seed plants.

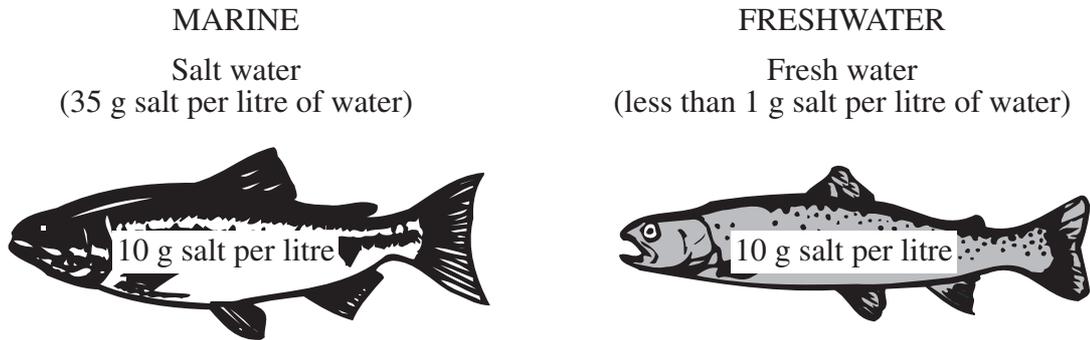
- (a) What are the predicted genotypes and phenotypic ratio of the first generation of plants? Show all working.
 - (b) These first generation plants are crossed with each other. Predict the genotypes and phenotypic ratio of this second generation. Show all working.
 - (c) Your observed phenotypic ratio does not exactly match your predicted phenotypic ratio. Suggest ONE reason why this may have occurred.
- 27** (a) ‘Parasites must be able to survive host defence mechanisms.’
- NAME a macroscopic parasite of humans, and describe TWO strategies that it uses to avoid host defences.
- (b) ‘During the course of evolution, parasites become less destructive to their hosts.’
- With reference to the human parasite that you named in part (a), explain TWO advantages of it being less destructive to the host.
- (c) ‘Transfer from one host to another is hazardous for a parasite.’
- Give ONE example of how the human parasite that you named in part (a) maximises survival during host-to-host transfer.

28 The table shows deaths for a non-infectious human disease.

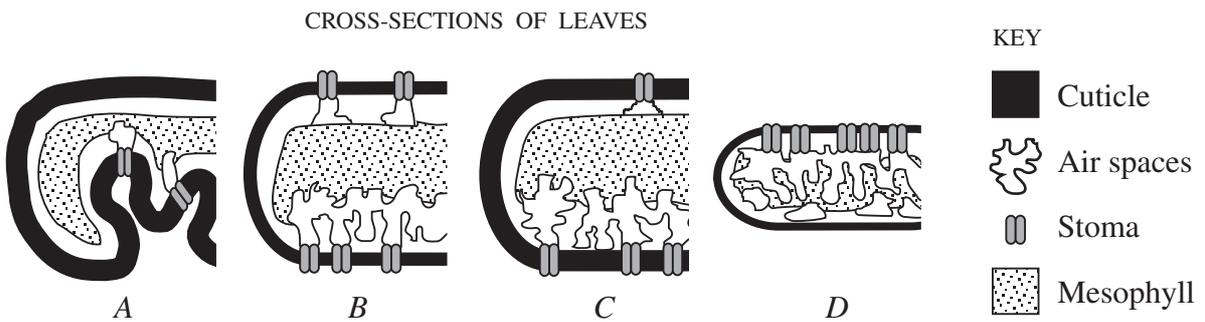
YEAR	DEATHS ($\times 100$)	
	<i>Male</i>	<i>Female</i>
1979	10	10
1981	12	14
1983	14	18
1985	16	24
1987	18	28
1989	18	32
1991	20	32
1993	20	34
1995	22	36
1997	20	34

- (a) Use the grid in the Part C Answer Book to graph ALL the data in the table.
- (b) How could this information be used?
- (c) Name ONE non-infectious human disease.
- (i) Describe ONE method of controlling this disease.
- (ii) Give ONE reason why this method of control is effective.

- 29 The following diagram represents a situation experienced by bony fish in marine (salt water) and freshwater environments.



- (a) State ONE problem for EACH fish that is caused by the difference in salt concentration in each of the TWO environments.
 - (b) State ONE example of a physiological adaptation that EACH fish may possess to overcome the problem.
 - (c) State ONE example of another method of overcoming this problem exhibited by other marine animals.
 - (d) Describe ONE other abiotic characteristic which differs between the marine and freshwater environments.
- 30 The diagram below shows cross-sections of leaves from a variety of terrestrial and aquatic plants. Each leaf is drawn to the same scale.



- (a) Describe THREE ways in which the structural features shown in the diagram affect the rate of water loss.
- (b) Which leaf is most likely to come from an aquatic plant? Explain your answer.
- (c) Which leaf is most likely to come from a desert plant? Explain your answer.

- 31** Mature nerve cells do not replicate their DNA because they no longer divide. A cell biologist found that there was a certain amount ' Q ' of DNA in a human nerve cell. The biologist then measured the amount of DNA in the four other types of human cells shown in the table.

<i>Type of cell</i>
• Sperm cell
• Intestinal cell just before cytokinesis
• Skin cell in the process of duplicating its DNA
• Bone cell just finished dividing

- (a) Predict the amount of DNA that the biologist may have found in EACH of the cells above. Explain EACH of your answers.
- (b) Could the proportion of adenine bases in the DNA of the skin cell in the process of duplicating its DNA differ from the proportion of adenine bases in the DNA of the nerve cell? Explain your answer.

SECTION II—ELECTIVES

(25 Marks)

Attempt ONE question.

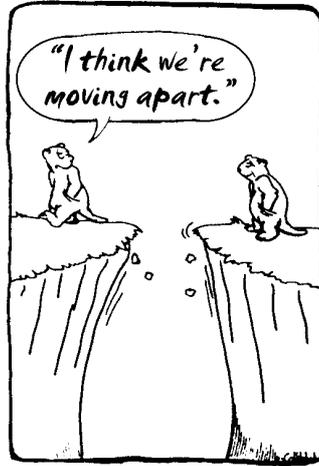
Each question is worth 25 marks.

Answer the question in a SEPARATE Elective Answer Book.

	Pages
QUESTION 32 The Australian Environment	20–24
QUESTION 33 Structure and Function of Cells and Tissues	25–27
QUESTION 34 Control and Coordination	28–31
QUESTION 35 Classification and the Species Concept	32–35
QUESTION 36 The Human Species	36–37
QUESTION 37 Genes in Action	38–42
QUESTION 38 Human Environmental Impact.....	43–45

QUESTION 32 The Australian Environment**Marks**

- (a) The cartoons depict factors that may have led to the present distribution of marsupials. **2**



CARTOON A



CARTOON B

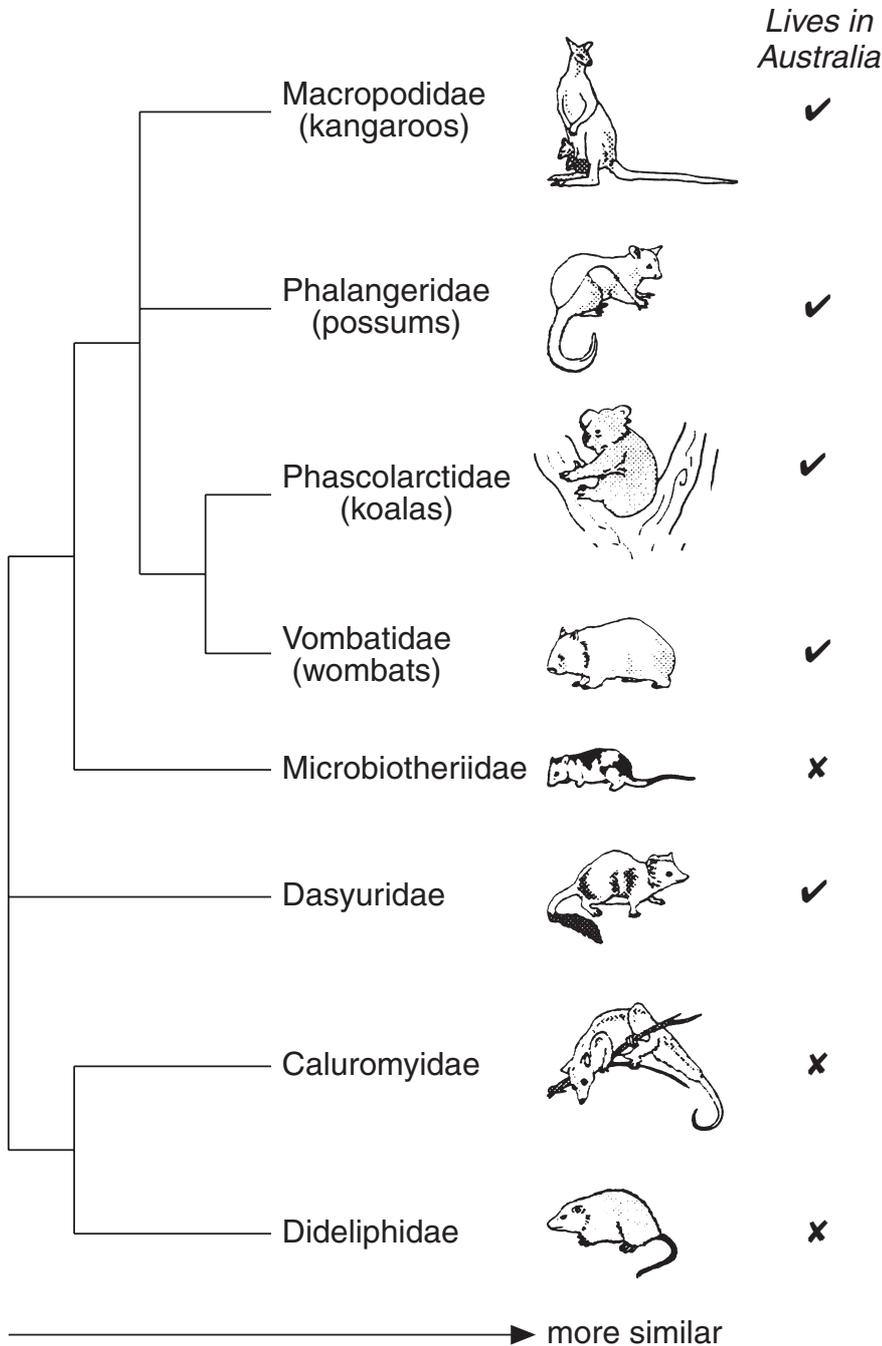
Select ONE cartoon and explain how it illustrates ONE of the factors that may have led to the present distribution of marsupials in Australia.

Question 32 continues on page 21

QUESTION 32 (Continued)

Marks

- (b) A family of small South American insect-eating marsupials, the Microbiotheriidae, have had their DNA sequenced. Based on their DNA sequence, the relationship between the Microbiotheriidae and other marsupials is shown. 2
- is shown.



Australian Journal of Zoology 45 (1997) pp 211-280. Reproduced with permission of CSIRO Publishing.

How could this evidence be used to support theories on the present distribution of indigenous marsupials in South America and Australia?

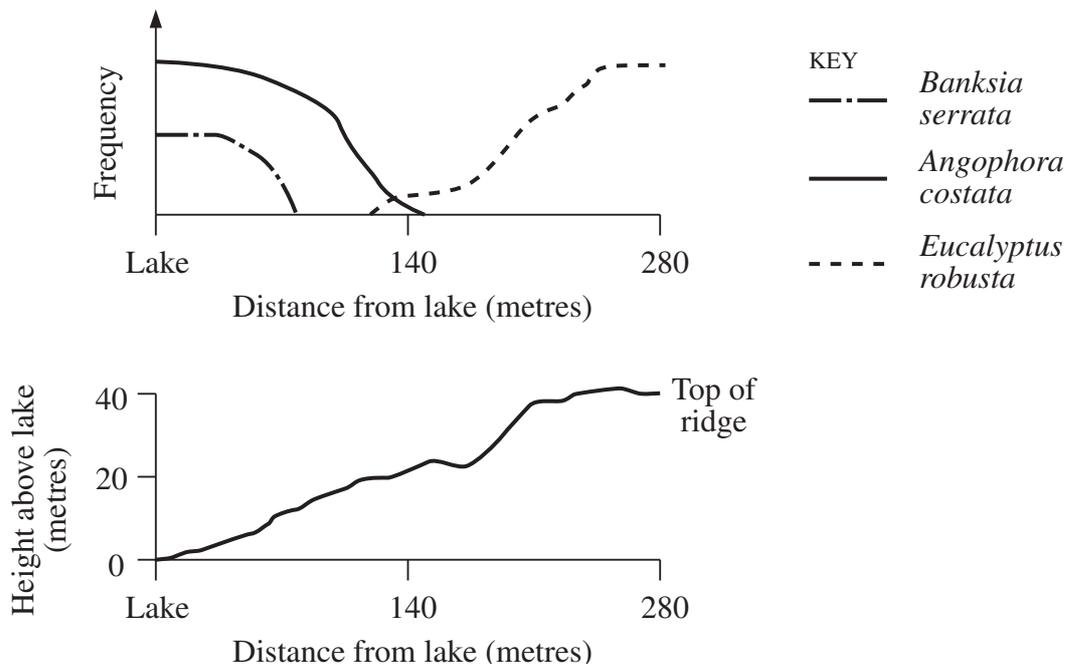
Question 32 continues on page 22

QUESTION 32 (Continued)

Marks

- (c) A survey was done to quantify the vegetation of the plant communities in the Myall Lakes area of NSW. A transect was run from the edge of the lake to the top of a ridge 280 m away. The top of the ridge was 40 m above the surface of the lake. 4

At regular points along the transect, the number of species of plants in a 10×10 m area was counted. The results of this study are shown.



Cunninghamia: a journal of plant ecology for eastern Australia vol 1 (4) 1986. Reproduced with permission of Royal Botanic Gardens Sydney.

- (i) Describe the pattern of vegetation along the transect.
- (ii) Which TWO environmental variables would you measure along this transect? Justify why you would measure these variables.
- (d) The Paperbark tea tree (*Melaleuca quinquenervia*) and the Coastal she-oak (*Casuarina equisetifolia*) were introduced to Florida, USA, where they are replacing natural vegetation. 3

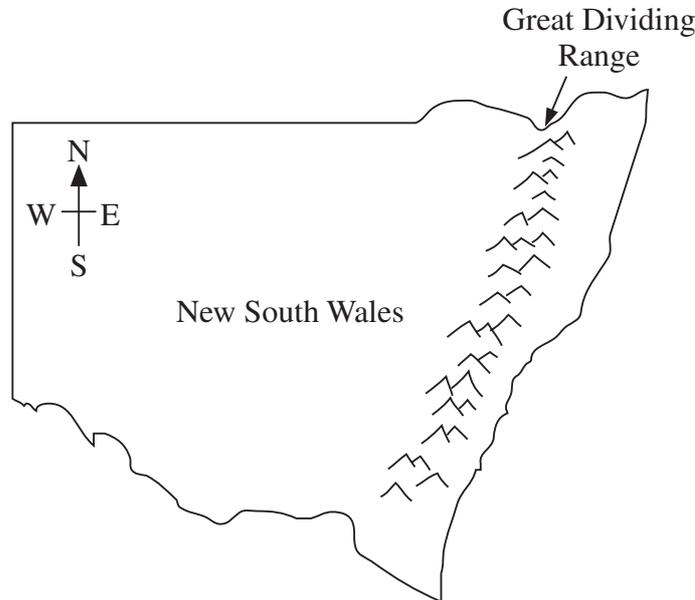
Give THREE factors to explain why Australian plants can flourish in this new ecosystem.

Question 32 continues on page 23

QUESTION 32 (Continued)

Marks

- (e) After thirty years of European settlement, a number of native species west of the mountains of the Great Dividing Range are thought to have become extinct. However, all the European settlers were on the eastern side of this Range. 3

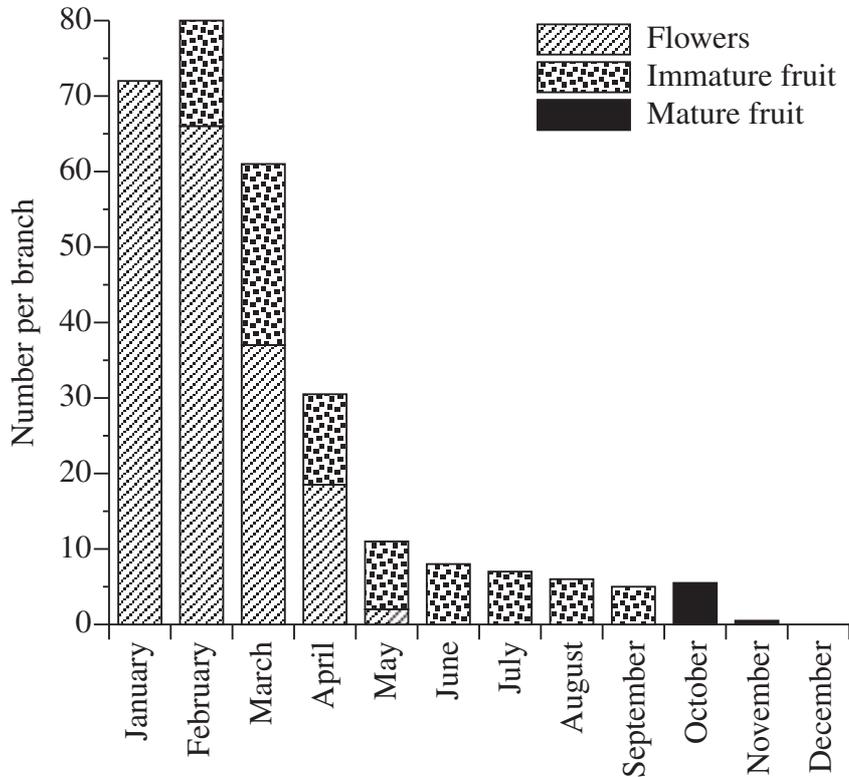


- (i) How could European settlements east of this Range have affected numbers of native species to the west of the range?
- (ii) In the early 1900s, there was a dramatic increase in the number of species becoming extinct. Describe TWO factors that could account for the increase in the rate of extinction during this period.
- (f) (i) As an ecologist, you have been given the task of investigating an ecosystem on an island that is uninhabited by humans. Describe in detail how you would investigate: 8
- 1 TWO abiotic factors;
 - 2 the distribution AND abundance of ONE plant and ONE animal.
- Include in your answer a list of equipment needed.
- (ii) Name ONE advantage and TWO potential problems of the method you have chosen to determine the distribution of the animal in part (i) 2.
- (iii) Humans accidentally introduce a disease that destroys the animal population described in part (i) 2. State ONE potential short-term and ONE potential long-term consequence to the ecosystem.

QUESTION 32 (Continued)

Marks

- (g) Mangrove trees grow in the tidal zone in river estuaries. The figure shows the pattern of reproduction in mature mangrove trees. 3



Australian Journal of Botany
24 (1994), 37-48, P Clark.
Reproduced with permission
of CSIRO Publishing.

- (i) Using only the information shown in the diagram, describe the life cycle of the tree.
- (ii) In this ecosystem, the mature fruit often fall into the tidal water, rather than on soil, as would the seeds of terrestrial plants.

Predict the effect on the size of the population of adult trees;

- 1 If excessive flowering resulted in a large number of fruits.
- 2 If, for many years, mature fruits were washed away from this population.

End of question

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

- (a) (i) 1 Name ONE specialised animal cell. State ONE characteristic that distinguishes this cell from other animal cells. **5**
- 2 How does this characteristic enable this cell to perform its specialised function?
- (ii) 1 Name ONE specialised plant cell. State ONE characteristic that distinguishes this cell from other plant cells.
- 2 How does this characteristic enable this cell to perform its specialised function?
- (iii) Could these cells named in parts (i) and (ii) survive as unicellular organisms? Explain your answer.
- (b) In some forms of fermentation, yeasts are used to produce ethanol from the sugars in fruit/vegetable juices. This process is carried out under anaerobic conditions. **5**
- (i) Describe the pathway by which yeasts convert sugars into ethanol.
- (ii) Predict what might happen to the rate of ethanol production under aerobic conditions. Explain your answer.
- (iii) Cyanide inhibits the passage of electrons along the cytochrome chain. What effect might cyanide have on ethanol production under:
- 1 aerobic conditions?
- 2 anaerobic conditions?

Question 33 continues on page 26

QUESTION 33 (Continued)

Marks

- (c) (i) In which part of a chloroplast would chlorophyll be found? 7
- (ii) Explain how, during photosynthesis, the interaction of light with chlorophyll results in the formation of:
- 1 oxygen;
 - 2 ATP.
- (iii) How are these compounds used to aid the conversion of carbon dioxide to starch? Name ONE other compound that is required.
- (iv) Some organisms, eg chemosynthetic bacteria, live underground and do not use light to generate the compounds required for carbon dioxide fixation. Instead, the essential compounds are generated by simple chemical reactions.
- Would you expect chemosynthetic bacteria to produce oxygen?
Explain your answer.

- (d) The diagram shows a long chain of amino acids (polypeptide) that makes up an enzyme. 4



In the active enzyme, the polypeptide wraps around itself to form a three-dimensional shape. This is called the 'folded' state.



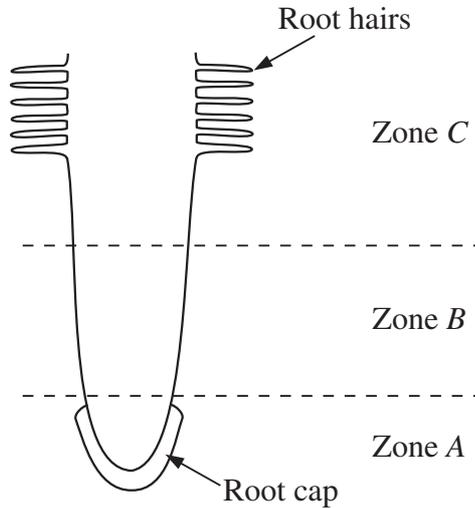
- (i) Explain why the enzyme needs to be in the folded state to convert substrate into product.
- (ii) Predict the effect of changing the sequence of amino acids in the polypeptide.

Question 33 continues on page 27

QUESTION 33 (Continued)

Marks

- (e) (i) Explain what is meant by the term *differentiation*. 4
- (ii) The diagram shows a growing root tip.



For EACH of the three zones marked on this diagram, draw a labelled diagram showing typical groups of cells for that zone.

End of question

QUESTION 34 Control and Coordination**Marks**

- (a) Name ONE specialised sensory organ you have studied that responds to light OR sound stimuli. **4**
- (i) How can the organ differentiate between EITHER black/white and other colours OR different sound frequencies?
- (ii) Draw a labelled diagram to illustrate the overall structure of this organ.
- 1 Label THREE structures, including the location of the specialised cells required to convert the stimuli into nerve impulses.
 - 2 Explain the function of EACH of these structures.
- (iii) Certain animals can detect wavelengths of sound or light different from those detected by humans. For example, they may detect very high frequency sounds or ultraviolet light. Why are humans unable to detect these different stimuli?

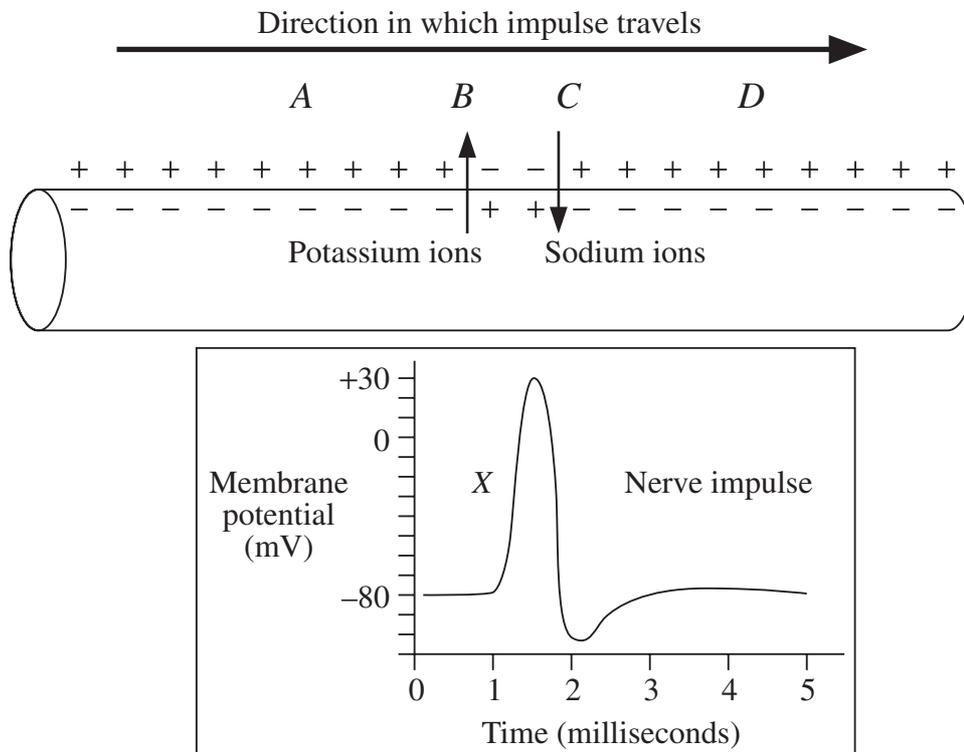
Question 34 continues on page 29

QUESTION 34 (Continued)

Marks

(b) The diagram shows a nerve impulse travelling along an axon.

4



- (i) At which point (*A*, *B*, *C* or *D*) does the depolarisation of the nerve impulse (marked *X* in the graph) commence? Explain your answer.
- (ii) What process maintains the equilibrium of the potassium and sodium ions after the membrane potential returns to its resting level?
- (iii) How does a nerve fibre transmit information that enables muscle fibres to vary the strength of contraction?
- (iv) Explain how nerve impulses can be transmitted in both directions along an axon, whereas transmission can occur in only one direction across a synapse.

Question 34 continues on page 30

QUESTION 34 (Continued)

Marks

- (c) Plants and animals respond to factors in their internal and external environments. Both possess hormones that are involved in communication between cells. **4**
- (i) Describe ONE major difference between plant and animal hormones in relation to their:
 - 1 function;
 - 2 site of production.
 - (ii) Name ONE plant hormone involved in phototropism.
 - (iii) Describe the effect of this hormone on the cells of the plant.
 - (iv) What advantage does phototropism provide for the growing plant?
- (d) (i) The endocrine system in mammals functions to control long-term homeostasis in the body, while the nervous system tends to control short-term events. Give TWO reasons for this difference. **4**
- (ii) Name an organ or tissue, and a response of it, that is coordinated or controlled by BOTH the nervous and endocrine systems.
 - (iii) Draw a labelled diagram to illustrate how these two systems control the function of this organ or tissue. Include details of the feedback mechanisms that maintain the function of the organ or tissue.
- (e) (i) Name ONE pituitary hormone. For this hormone describe: **2**
- 1 the response in the target cell;
 - 2 how the release of the hormone is regulated.
- (ii) We now have the technology to manufacture human hormones to treat people with hormone deficiencies. Why do these artificial hormones interact specifically with the target cell and not with other types of cells?

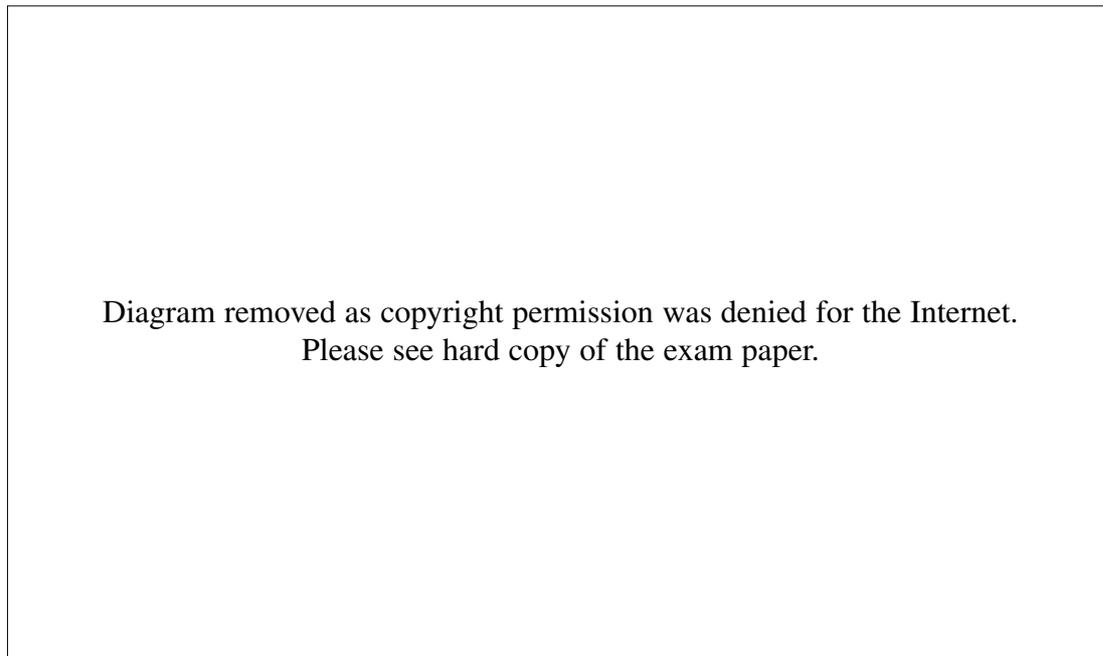
Question 34 continues on page 31

QUESTION 34 (Continued)

Marks

- (f) The diagram shows two different types of neurones.

4



- (i) Label the structures marked *W*, *X*, *Y* and *Z* on neurone *P*.
- (ii) Name EACH type of neurone.
- (iii) State the function of neurone *Q*.
- (g) (i) Name TWO tissues or organs that are controlled by the autonomic nervous system. 3
- (ii) Explain the role of the autonomic nervous system in controlling one of the tissues or organs you named in part (i).
- (iii) State ONE difference between the peripheral nervous system and the autonomic nervous system.

End of question

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

- (a) The species is the basic unit of classification in the hierarchical system used by biologists. **4**
- (i) Beginning with the species level, list the levels of classification in the correct order.
 - (ii) Describe ONE advantage and ONE disadvantage of using this classification system.
 - (iii) Why is it difficult to classify fossils?
- (b) Biologists use a binomial system to name organisms. In this system, each organism has a two-word name. **4**
- (i) Why is it necessary to use BOTH the genus and species names to identify an organism?
 - (ii) Discuss TWO disadvantages and ONE advantage of using common names instead of binomial names.

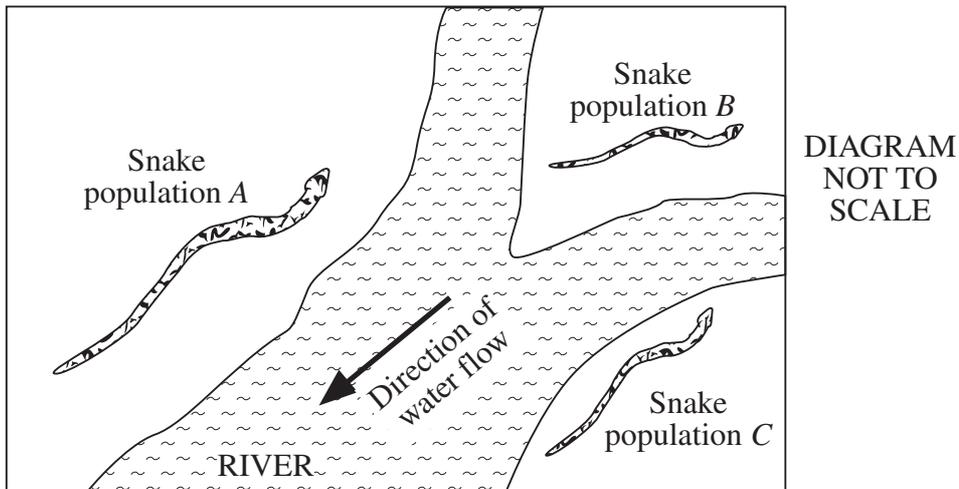
Question 35 continues on page 33

QUESTION 35 (Continued)

Marks

- (c) The diagram shows the distribution of three populations of snakes.

4



The table summarises information about these three populations of snakes.

<i>Population</i>	<i>Predominant body colour</i>	<i>Average length of adult</i>	<i>Observed to produce viable offspring with</i>
<i>A</i>	Dark brown	2.0 m	<i>A and B</i>
<i>B</i>	Light brown	1.5 m	<i>A, B and C</i>
<i>C</i>	Red brown	1.0 m	<i>B and C</i>

- (i) How many species of snake are there in the area shown in the diagram? Explain your answer.
- (ii) Suggest a mechanism that could lead to a change in the number of snake species in this habitat.
- (iii) Discuss TWO other mechanisms that can lead to the formation of new species. Give ONE example of each.

Question 35 continues on page 34

QUESTION 35 (Continued)

Marks

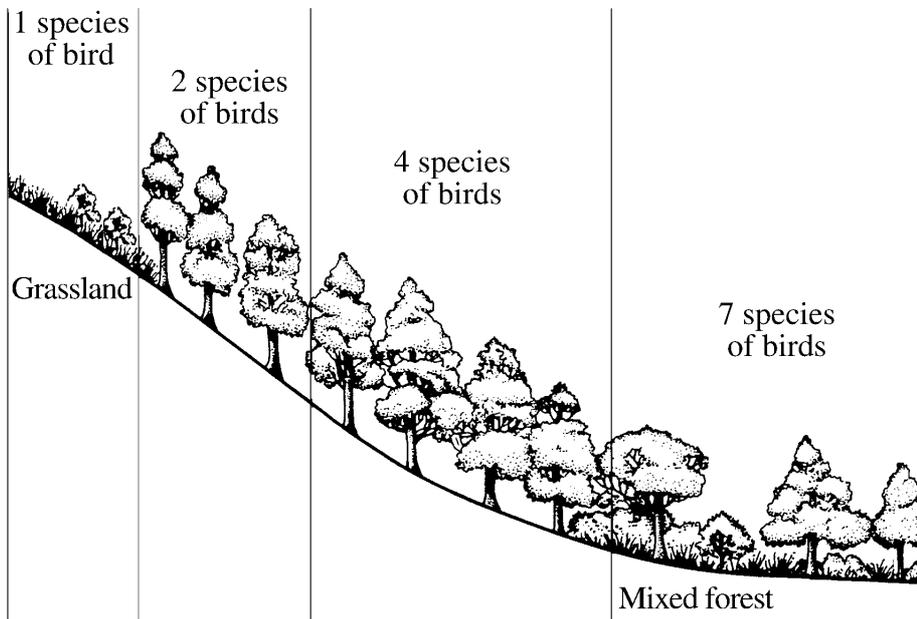
- (d) Name TWO orders of insects that you have studied. Use examples from these orders in your answers to the following questions. **5**
- (i) Name FOUR characteristics you would use to justify classifying an organism as an insect.
 - (ii) Describe TWO characteristics you would use to decide whether an insect specimen belonged to one of the orders you have studied.
 - (iii) Describe TWO common characteristics of insects you would NOT use to classify this specimen at the order level. Explain your answer.
- (e) A biologist discovers two unknown plants in a remote area. The plants have many similarities but are found in different locations. **4**
- (i) Describe in detail THREE characteristics of the plants that you would study in order to determine whether the plants are the same species.
 - (ii) What additional information do you require in order to determine whether these plants may belong to the same species?

Question 35 continues on page 35

QUESTION 35 (Continued)

Marks

- (f) The diagram shows the numbers of bird species present in different parts of a mountainside. 4



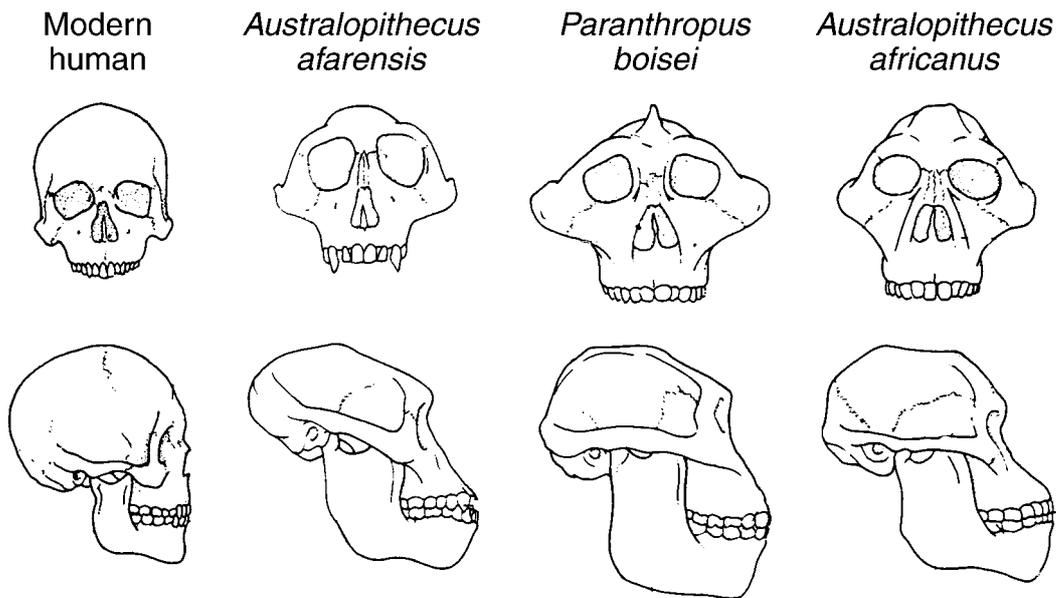
*Augee, M and Fox, M, Vilogy of Australia and New Zealand, Sydney, pearson Education, 2000.
Reproduced with permission of Pearson Education Australia.*

- (i) What is a *cline*?
- (ii) Why does the information concerning the numbers of bird species NOT represent a cline?
- (iii) How would you determine whether the trees on the mountainside form a cline?

End of question

QUESTION 36 The Human Species**Marks**

- (a) Humans are members of the Class Mammalia and the Order Primates. Justify this classification at both the class and the order level. **2**
- (b) Humans are classified as *Homo sapiens*. State **THREE** characteristics that identify an organism as being a member of *Homo sapiens*. Explain **ONE** possible adaptive advantage of each characteristic. **3**
- (c) In the study of human evolution, the same piece of evidence has been interpreted differently by researchers. Explain why this has occurred. Include at least **TWO** examples of evidence in your answer. **2**
- (d) Identify **THREE** evolutionary changes that are evident when the skull of the modern human is compared with the other skulls below. Suggest **ONE** reason for each change. **6**



*Jones, Martin & Pilbeam, Cambridge Encyclopedia of Human Evolution, 1992, p 402 © Cambridge University Press.
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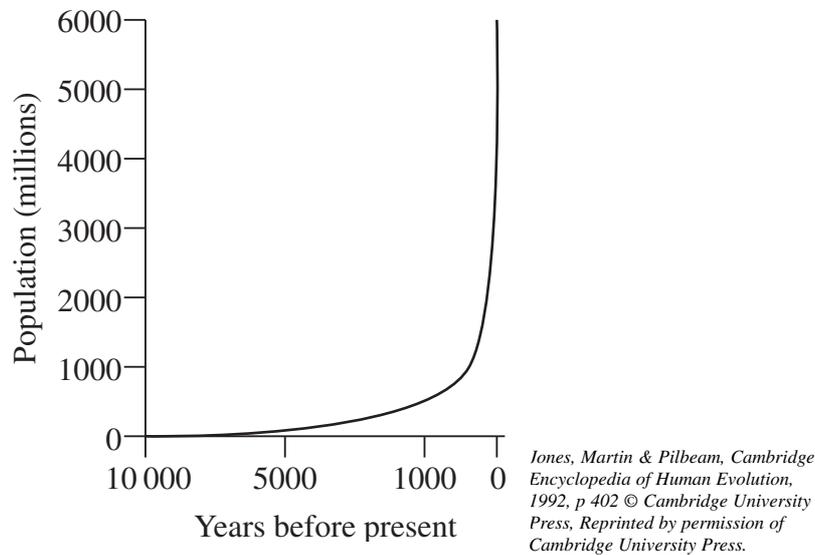
Question 36 continues on page 37

QUESTION 36 (Continued)

Marks

(e) The graph shows human population growth over the last 10 000 years.

5



- (i) The gradual change that occurred between 10 000 and 400 years ago was probably due to the development of agricultural techniques. Explain how this development was able to influence the rate of growth of the human population.
- (ii) Suggest a reason for the rapid increase in the human population within the last 200 years. Explain your answer.
- (iii) How could improved technology and genetic techniques influence the pattern of human growth over the next 1000 years?
- (f) (i) Define the term *polymorphic*. 3
- (ii) Give TWO examples of polymorphism in humans, and suggest ONE possible adaptive advantage for each.
- (g) ‘Cultural development in humans includes the passing on of learnt behaviours.’ 4
- (i) Justify this statement, using TWO cultural examples.
- (ii) Sometimes it is difficult to find evidence of cultural development. Give TWO reasons for this.

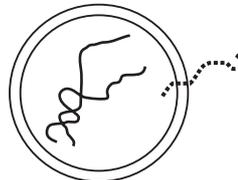
End of question

QUESTION 37 Genes in Action**Marks**

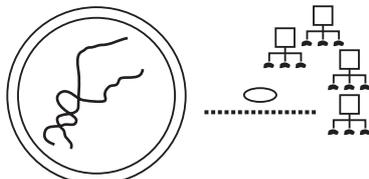
- (a) The diagram represents the process in which information from the DNA molecule results in the production of specific proteins (polypeptides). Labels have been omitted deliberately. **4**



Step 1



Step 2



Step 3



Step 4

- (i) Describe what is happening in EACH of the steps.
- (ii) State TWO reasons why an error in Step 1 may NOT have serious consequences for the cell.
- (b) Mutations may be classified as point mutations or as chromosomal mutations. **4**
- (i) Describe ONE type of chromosomal mutation and ONE type of point mutation. Which of these mutations is more likely to have serious effects on the individual? Explain your answer.
- (ii) State TWO environmental factors that are known to increase the mutation rate.
- (iii) Are all mutations harmful to the individual? Give ONE specific example of a human mutation to explain your answer.

Question 37 continues on page 39

QUESTION 37 (Continued)

Marks

- (c) The Human Genome Project is an attempt to map all of the genes of the human genome. The project was started in 1990 and is due for completion in 2003. Today, there are a number of techniques available to analyse directly the DNA base sequence of chromosomes. Traditionally, mapping was achieved by using recombination frequencies between genes. 4
- (i) A particular insect chromosome is known to contain four autosomal genes, B, R, H, L. Describe how such genes may be mapped using recombination frequencies for these genes.
 - (ii) The Human Genome Project offers many possible benefits for humans, but it also raises some possible ethical issues. Give ONE example of such a benefit and ONE example of an ethical question raised by the Human Genome Project.
- (d) Humans have practised techniques of genetic manipulation ever since an agricultural lifestyle and domestication of animals was adopted. Early techniques included artificial selection and crossbreeding. Recently, more advanced methods of direct manipulation of the DNA base sequencing have become available. 4
- (i) Distinguish between the techniques of artificial selection and crossbreeding of animals and plants.
 - (ii) Describe ONE technique of direct DNA manipulation that may be used to produce benefits for the human race.

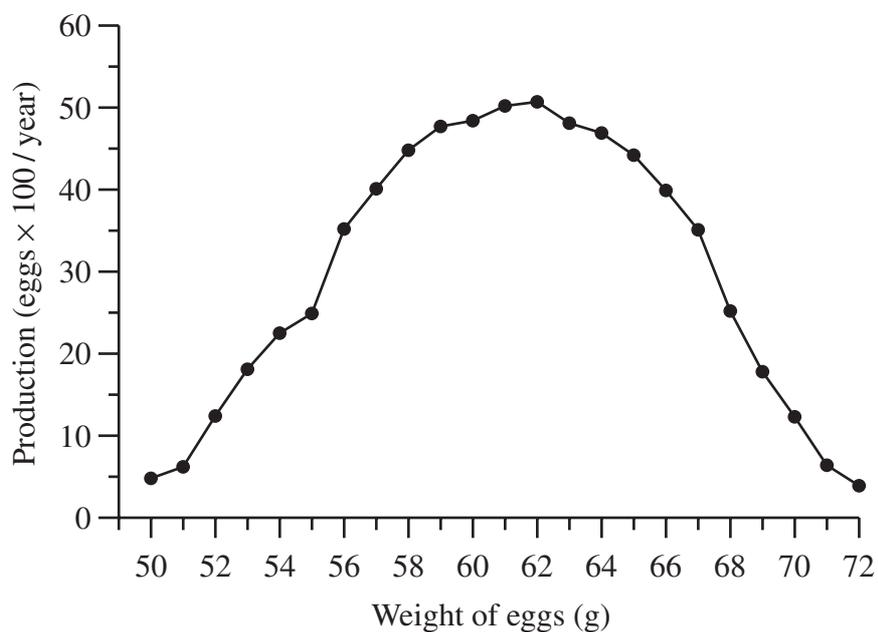
Question 37 continues on page 40

QUESTION 37 (Continued)

Marks

(e) The graph shows the egg production figures (by weight) of a poultry farm.

2



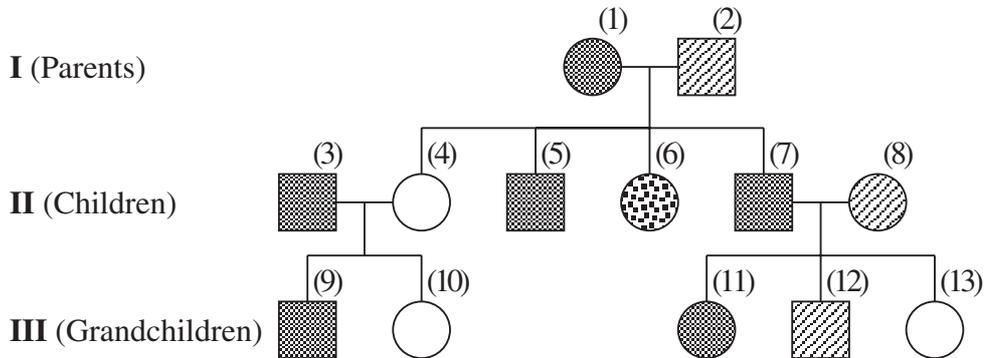
Describe the shape of this curve and the possible genetic processes that control the weight of eggs in the poultry.

Question 37 continues on page 41

QUESTION 37 (Continued)

Marks

- (f) The following pedigree describes the inheritance of blood groups in a particular family. 4



KEY	Male A	Female A	Male AB	Female AB	Male B	Female B

- (i) Predict the genotypes of both parents (individuals (1) and (2)).
- (ii) If individuals (7) and (8) were to have another child, what would be the chance of it having blood group AB? Show all your working.

Question 37 continues on page 42

QUESTION 37 (Continued)

Marks

- (g) The following diagram shows a section of DNA (gene) in a particular genome.
- 3

A A T A T A C G C A A G A A T A A T G A T T

Methionine is always the first amino acid in a protein.

Using the base sequence in the coding strand of DNA, and the mRNA codon–amino acid table below, predict the amino acid sequence that would be produced by the above gene. Show all of your working.

mRNA CODON — AMINO ACID TABLE

UUU } UUC } phe UUA } UUG } leu	UCU } UUC } UCA } ser UCG }	UAU } UAC } tyr UAA stop UAG stop	UGU } UGC } cys UGA stop UGG } trp
CUU } CUC } CUA } leu CUG }	CCU } CCC } CCA } pro CCG }	CAU } CAC } his CAA } CAG } gln	CGU } CGC } CGA } arg CGG }
AUU } AUC } ile AUA } AUG met (start)	ACU } ACC } ACA } thr ACG }	AAU } AAC } asn AAA } AAG } lys	AGU } AGC } ser AGA } AGG } arg
GUU } GUC } GUA } val GUG }	GCU } GCC } GCA } ala GCG }	GAU } GAC } asp GAA } GAG } glu	GGU } GGC } GGA } gly GGG }

Abbreviated names of amino acids are as follows.

ala = alanine	arg = arginine	asn = asparagine	asp = aspartic acid
cys = cysteine	gln = glutamine	glu = glutamic acid	gly = glycine
his = histidine	ile = isoleucine	leu = leucine	lys = lysine
met = methionine	phe = phenylalanine	pro = proline	ser = serine
thr = threonine	trp = tryptophan	tyr = tyrosine	val = valine

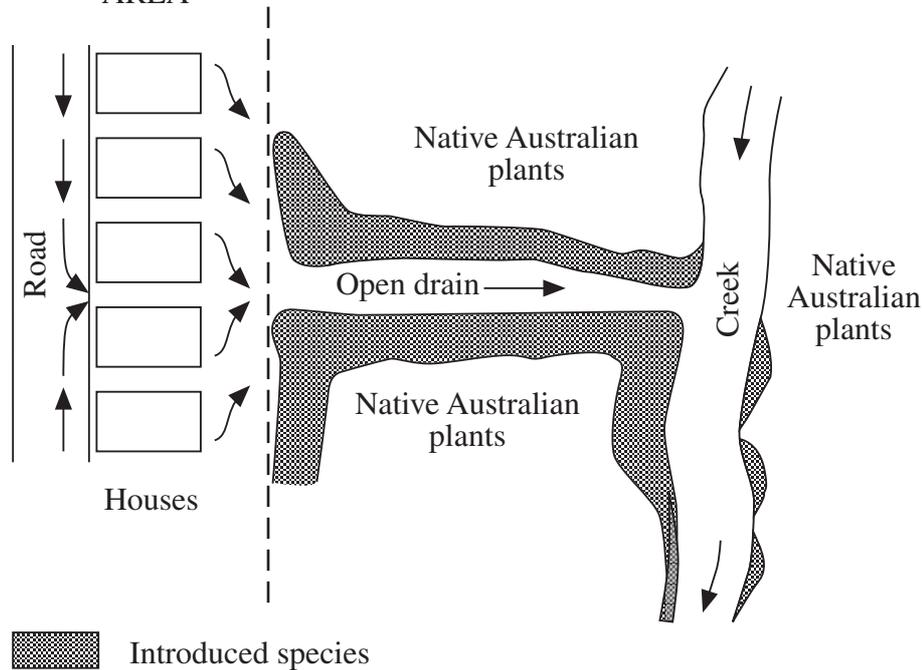
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QUESTION 38 Human Environmental Impact**Marks**

(a)

URBAN
AREA

BUSHLAND

8

The diagram shows a section of native Australian bushland that lies adjacent to an urban area. A drain takes stormwater from the road and nearby houses to a creek. The arrows indicate the direction in which water flows after a period of rain.

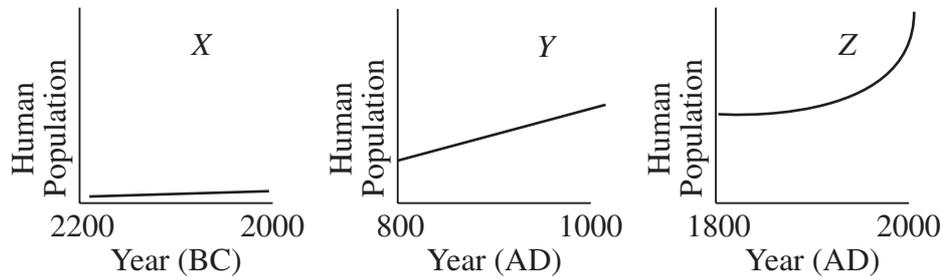
- (i) Give TWO possible reasons for the observed distribution of introduced species and native Australian plants.
- (ii) Comment on the suitability of EACH of the following measures to eradicate the introduced species.
 - 1 Spraying the affected areas with herbicide.
 - 2 Removal of the introduced species by hand, followed by the replanting of native species.
 - 3 Diverting stormwater flow into a dam or reservoir.
- (iii) Name TWO pollutants originating from the road that could be found in the stormwater.
- (iv) Describe the source of EACH of the pollutants named in part (iii).
- (v) Describe ONE possible effect of EACH pollutant on organisms in the creek.

Question 38 continues on page 44

QUESTION 38 (Continued)

Marks

- (b) The three graphs show the growth in the human population over different periods. 4



- (i) Describe the patterns of growth in the human population shown by the graphs.
 - (ii) Describe ONE change in human activity that has resulted in the difference between graphs X and Y.
 - (iii) State TWO human activities that resulted in the difference between graphs Y and Z.
- (c) Resources may be classified as renewable or non-renewable. 4
- (i) Give ONE example of a non-renewable energy resource.
 - (ii) Describe TWO measures that may be taken to conserve this non-renewable energy resource.
 - (iii) Describe ONE renewable alternative to this non-renewable energy resource.
 - (iv) Describe TWO problems associated with the renewable energy resource you identified in part (iii).

Question 38 continues on page 45

QUESTION 38 (Continued)

Marks

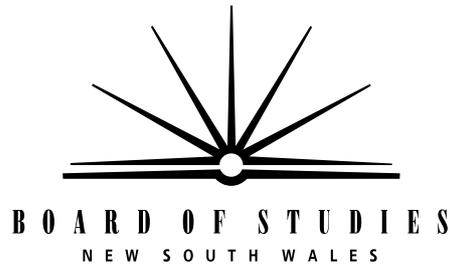
- (d) At least 175 species of Australian fauna are on the current endangered list. **3**
- (i) What is meant by the term *endangered*? How would this be determined for a particular species?
 - (ii) Name ONE endangered species, and describe TWO management strategies that could be used to minimise the current threats to this species.
- (e) Monoculture is an agricultural practice in which extensive areas of land are used to grow a single species (eg pine plantations). **2**
- (i) Describe ONE impact this practice could have on the native species in this area.
 - (ii) Some monocultures require intensive irrigation. Explain the long-term detrimental effect this has on the environment.
- (f) It was recently estimated that the cereal yield per hectare needs to double by the year 2020 to feed the anticipated world population of 7.7 billion. In order to sustain food supplies, the usage of pesticides to combat agricultural pests will need to be increased. **3**
- (i) Describe TWO factors that limit the current usage of conventional chemical pesticides.
 - (ii) Describe ONE method that could limit, or is limiting, the impact of pesticides on the environment.
- (g) How might controlled burning assist in the regeneration of native bushland? **1**

End of paper

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BIOLOGY

2 UNIT

PART B ANSWER BOOK

DIRECTIONS TO CANDIDATES

- Write your Student Number and Centre Number at the top right-hand corner of this page.
- You should receive this Answer Book with an Answer Sheet for Part A, a Part C Answer Book, and an Elective Answer Book.
- Answer Questions 16 to 25 in this Answer Book.
- Each question is worth 3 marks.
- All drawings should be done in 'HB' pencil.

MARKER'S USE ONLY

PART	Mark	Marker	Check
B			

Questions 16 to 25 are worth 3 marks each.
Answer the questions in the spaces provided below.

MARKER'S
USE ONLY

16 (a)

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(b)

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17 (a)

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MARKER'S
USE ONLY

18 (a)

(b)

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19 (a) (i)

(ii)

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(b) (i)

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(ii)

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MARKER'S
USE ONLY

20 (a)

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(b)

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21 (a)

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(b)

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(c) (i)

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(ii)

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MARKER'S
USE ONLY

22 (a)

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(b)

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(c)

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23 (a)

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(b)

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MARKER'S
USE ONLY

24 (a)

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(b)

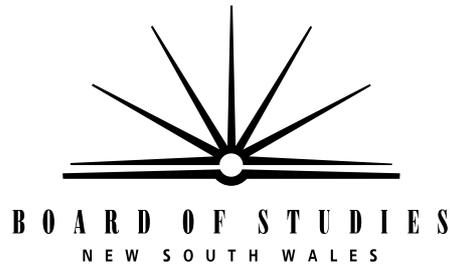


25 (a)

(b)
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BIOLOGY

2 UNIT

PART C ANSWER BOOK

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- Write your Student Number and Centre Number at the top right-hand corner of this page.
- You should receive this Answer Book with an Answer Sheet for Part A, a Part B Answer Book, and an Elective Answer Book.
- Answer Questions 26 to 31 in this Answer Book.
- Each question is worth 5 marks.
- All drawings should be done in 'HB' pencil.

MARKER'S USE ONLY

PART	Mark	Marker	Check
C			

Questions 26 to 31 are worth 5 marks each.
Answer the questions in the spaces provided below.

MARKER'S
USE ONLY

26 (a)

(b)

QUESTION 26 (Continued)

MARKER'S
USE ONLY

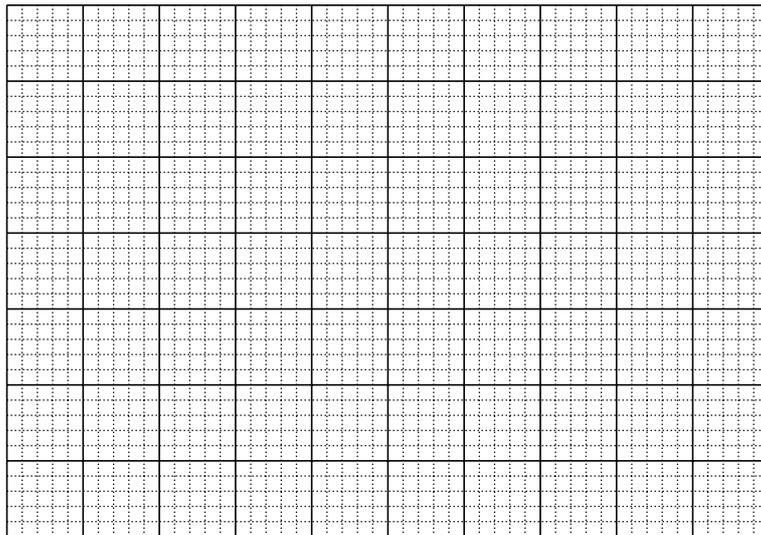
(c)
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27 (a)
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(b)
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(c)
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28 (a)



(b)
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(c)

(i)
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(ii)
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MARKER'S
USE ONLY

29 (a)
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(b)
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(c)
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(d)
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MARKER'S
USE ONLY

30 (a)
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(b)
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(c)
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31 (a)

<i>Type of cell</i>	<i>Amount of DNA</i>	<i>Explanation</i>
<ul style="list-style-type: none"> Sperm cell 		<p>.....</p> <p>.....</p> <p>.....</p>
<ul style="list-style-type: none"> Intestinal cell just before cytokinesis 		<p>.....</p> <p>.....</p> <p>.....</p>
<ul style="list-style-type: none"> Skin cell in the process of duplicating its DNA 		<p>.....</p> <p>.....</p> <p>.....</p>
<ul style="list-style-type: none"> Bone cell just finished dividing 		<p>.....</p> <p>.....</p> <p>.....</p>

(b)

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.....

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