



HIGHER SCHOOL CERTIFICATE EXAMINATION

1996
BIOLOGY
2 UNIT

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

DIRECTIONS TO CANDIDATES

- Board-approved calculators may be used.

Section I—Core

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

Section II—Electives

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

SECTION I—CORE

(75 Marks)

Attempt ALL questions.

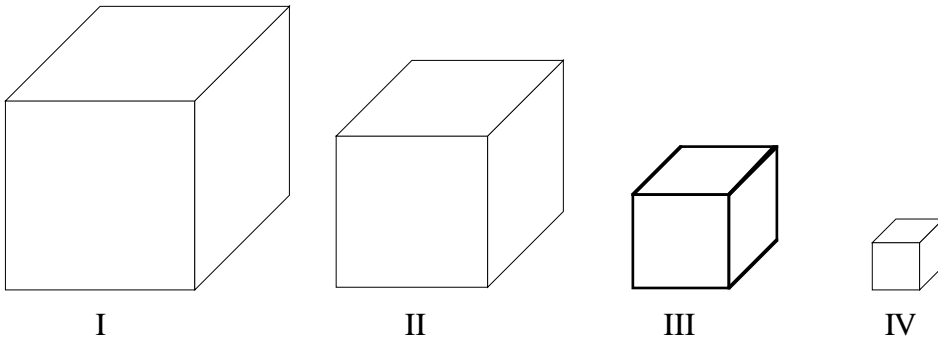
PART A

Questions 1–15 are worth 1 mark each.

Mark your answers in pencil on the Answer Sheet provided.

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

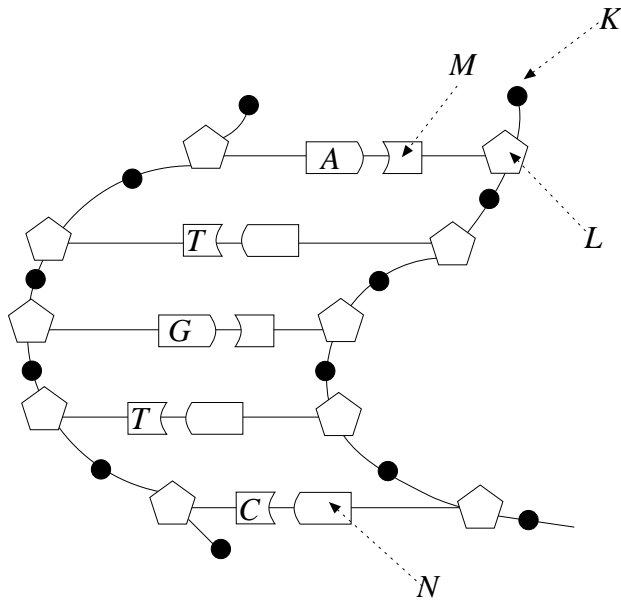
1. Four cubes of different volume are shown below.



The cube with the highest surface area to volume ratio is

- (A) I
 - (B) II
 - (C) III
 - (D) IV
2. When an animal cell is placed in distilled water, the cell
- (A) shrinks because cytoplasm diffuses out of the cell.
 - (B) shrinks because of the pressure exerted by the water on the cell surface.
 - (C) stays the same size because the cell wall prevents any increase in size.
 - (D) swells because water diffuses into the cell.

3. If a fertilised egg splits early in development, two genetically identical offspring (identical twins) can be produced. The small differences we notice between identical twins must be a result of
- (A) the influence of the environment on the phenotype.
 - (B) incomplete dominance.
 - (C) random segregation of the chromosomes.
 - (D) crossing over.
4. Molecules on the surface of some bacteria can stimulate an immune response. These molecules are examples of
- (A) antibodies.
 - (B) antigens.
 - (C) lymphocytes.
 - (D) phagocytes.
5. Part of a DNA molecule is shown below.



The structures labelled *K*, *L*, *M*, and *N* are, respectively,

- (A) phosphate group, sugar group, thymine, guanine.
- (B) thymine, guanine, phosphate group, sugar group.
- (C) guanine, thymine, phosphate group, sugar group.
- (D) sugar group, phosphate group, guanine, thymine.

6. According to fossil evidence, sharks have changed very little since the late Triassic period. The most likely reason for this is that sharks
- (A) are able to adapt to changes in their environment.
 - (B) are too fierce to be attacked by other animals.
 - (C) do not evolve.
 - (D) live in environments similar to those where they evolved.
7. Parasites
- (A) are always transmitted by insects.
 - (B) are all microscopic.
 - (C) live on or in the host, without any effect on the host.
 - (D) live on or in the host, and cause harm to the host.
8. In response to a bacterial infection, B-cells
- (A) engulf the organism.
 - (B) produce T-cells.
 - (C) manufacture antibodies.
 - (D) produce antigens.
9. Immunisation usually involves the introduction into the body of
- (A) plasma cells.
 - (B) killer T-cells.
 - (C) non-specific phagocytes.
 - (D) samples of a pathogen.
10. An example of a structural adaptation of animals to low temperature is
- (A) a thick layer of fur.
 - (B) hibernation.
 - (C) living underground in a burrow.
 - (D) migration to a warmer region.

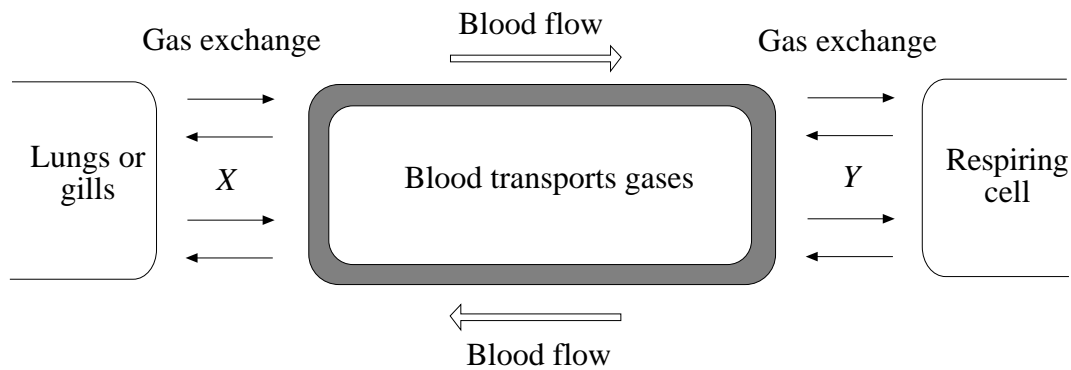
- 11.** Water lilies are flowering plants adapted to an aquatic environment. You would expect these plants to have
- (A) abundant woody tissues and a thick waxy layer on the leaves.
 - (B) small hard leaves with few stomates.
 - (C) air-filled chambers and stomates on the upper surface of the leaves.
 - (D) streamlined body shape and little turgidity.
- 12.** DNA replication is part of the overall process of
- (A) photosynthesis.
 - (B) osmosis.
 - (C) meiosis.
 - (D) respiration.
- 13.** Above 40°C the rate of transpiration falls in many plants because the plant
- (A) sheds root hairs.
 - (B) reduces the rate of transport in the phloem.
 - (C) closes the stomates.
 - (D) collapses xylem vessels.
- 14.** Light penetration into leaves is promoted by
- (A) hairy surfaces.
 - (B) transparent cuticles.
 - (C) large numbers of stomates.
 - (D) the presence of chloroplasts in the epidermis.
- 15.** As a result of meiosis, cells are formed which contain
- (A) one copy of every gene.
 - (B) two copies of every gene.
 - (C) four copies of every gene.
 - (D) eight copies of every gene.

PART B

Questions 16–25 are worth 3 marks each.

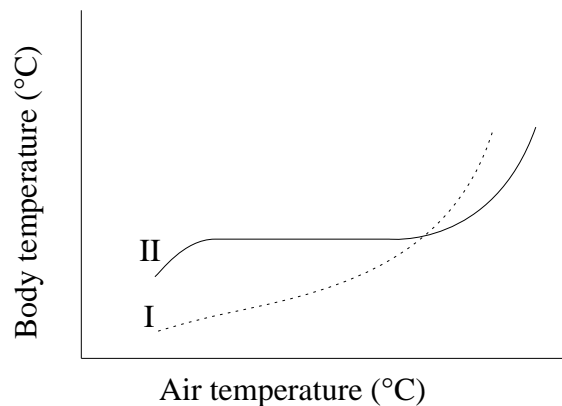
Answer this Part in the Part B Answer Book.

16. The diagram below represents the gas exchange between an organism and its environment.



- (a) Name TWO gases exchanged at point X.
- (b) Name the process by which gases are exchanged at points X and Y.
- (c) List TWO structural characteristics that make lungs and gills efficient surfaces for gas exchange.
- (d) Explain why a constant flow of blood is needed to maintain the exchange of gases at point Y.
17. (a) List THREE abiotic characteristics that are different between aquatic and terrestrial environments.
- (b) Describe how *each* of these characteristics differs between the two environments.
18. Three points of entry of pathogenic organisms into the human body are listed below.
- For *each* of these, describe TWO mechanisms that are used to limit the entry of pathogens.
- (a) Skin.
- (b) Urinogenital surfaces.
- (c) Respiratory surfaces.

19. The graph below represents the relationship between body temperature and air temperature for two groups of animals, ectotherms and endotherms.

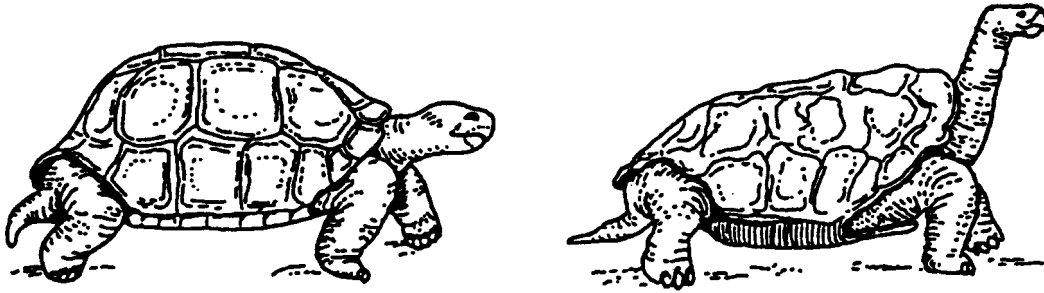


- (a) Name the group of animals (ectotherms or endotherms) represented by curve I. Explain your answer.
- (b) Describe a *structural* adaptation used by *ectotherms* to regulate their body temperature.
- (c) Describe a *physiological* adaptation used by *endotherms* to regulate their body temperature.
20. Diseases may be caused by pathogenic micro-organisms.
- (a) Name such a disease.
- (b) Describe the route(s) of entry of the pathogenic micro-organism into the host.
- (c) Describe the role of the environment in the transmission of the pathogenic micro-organism.
- (d) Describe the effect of the pathogenic micro-organism on the host.
- (e) Describe any possible methods of control.
21. Desert lizards are able to maintain their body temperature at about 38°C by moving in and out of the sun. When these lizards become infected with certain bacteria, they spend more time in the sun and their body temperature is maintained at about 42°C.
- One hypothesis to explain why lizards spend more time in the sun is that the lizards are better able to fight the infection if their body temperature is higher.
- (a) Describe the design of an experiment to test this hypothesis.
- (b) What would the results of your experiment be if the hypothesis were not correct?

22. There are two main types of tortoise on the Galapagos Islands. One has a domed shell and short neck and lives on the moister islands; the other variety has a shell that allows its long neck to be raised.

The long-necked variety lives on the drier islands where the vegetation mainly consists of tall shrubs and bushes.

THE TWO MAIN TYPES OF TORTOISE FOUND ON THE GALAPAGOS ISLANDS



'Biology Today', Wilkinson & Nash, Macmillan Education Australia 1989. p111, fig.2.

- (a) How would Darwin's theory of evolution explain the evolution of the long-necked form of the Galapagos tortoise?
- (b) How would Lamarck's theory of evolution explain the evolution of the long-necked form of the Galapagos tortoise?
23. (a) Explain the difference between infectious and non-infectious diseases.
- (b) Name a non-infectious disease that you have studied. For this disease, describe:
- (i) its causes;
 - (ii) the effects it has on the organism;
 - (iii) the methods used to control this disease.
24. In humans, sex-linked genes are located on the X chromosome.
- (a) Briefly explain why men are more likely to express recessive sex-linked genes in their phenotype than are women.
- (b) A woman heterozygous for a sex-linked gene marries a man who also carries the recessive allele. Can this couple produce a son with the same phenotype as the father? Explain.

25. Two species of baleen whale from Antarctic waters are shown below.

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COULD NOT BE REPRODUCED HERE. PLEASE SEE HARD COPY
OF EXAMINATION PAPER.**

SEI WHALE (*Balaenoptera borealis*)

HUMPBACK WHALE (*Megaptera novaeangliae*)

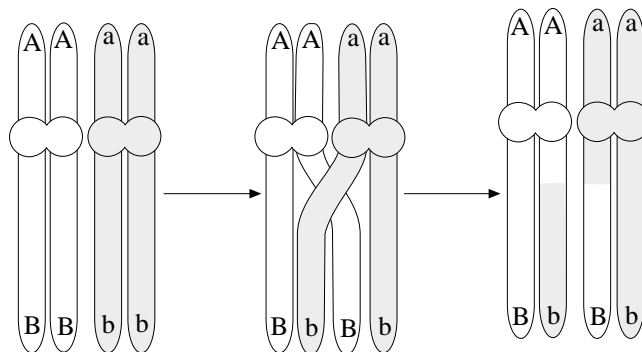
- (a) List TWO structural adaptations that enable these animals to move freely in an aquatic environment.
- (b) Explain how EACH of the adaptations you have named in part (a) assists the whales to move through water.
- (c) These whales have a thick layer of fat (blubber) under their skin. Suggest ONE reason why this is an advantage to these animals.

PART C

Questions 26–31 are worth 5 marks each.

Answer this Part in the Part C Answer Book.

- 26.** There are many lines of evidence that support the theory of biological evolution. One of these is the existence of transitional forms.
- What is a transitional form?
 - How do transitional forms provide evidence for the theory of biological evolution?
 - Name ONE example of a transitional form, and name the TWO groups of organisms between which it is transitional.
 - Describe TWO other lines of evidence supporting the theory of biological evolution.
- 27.** A pair of homologous chromosomes undergoing the process of crossing over during meiosis is shown below. Alleles of two genes on these chromosomes are indicated by the letters A, a, B, b.

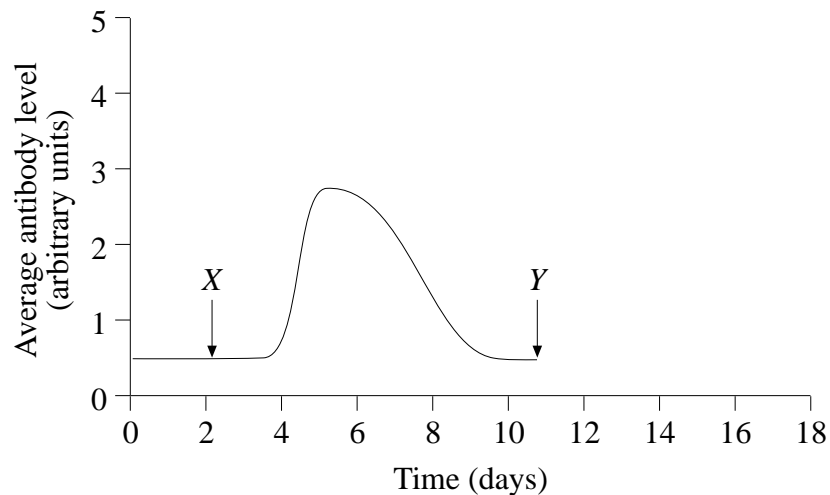


- For this pair of chromosomes:
 - give the genotype of the parent cell;
 - give the genotype of each daughter cell at the completion of meiosis.
- Crossing over is one method of introducing variation into the next generation. Name TWO other mechanisms that produce genetic variations.
- Outline the evolutionary advantage of producing offspring that may vary from each other, and from their parents.

28. (a) Individuals in an isolated village become sick. A physician establishes that all the sick individuals are infected with a particular strain of bacteria. A sample of this strain is taken from a sick individual and grown in pure culture away from the sick individual. This strain of bacteria was not found in any healthy individuals.

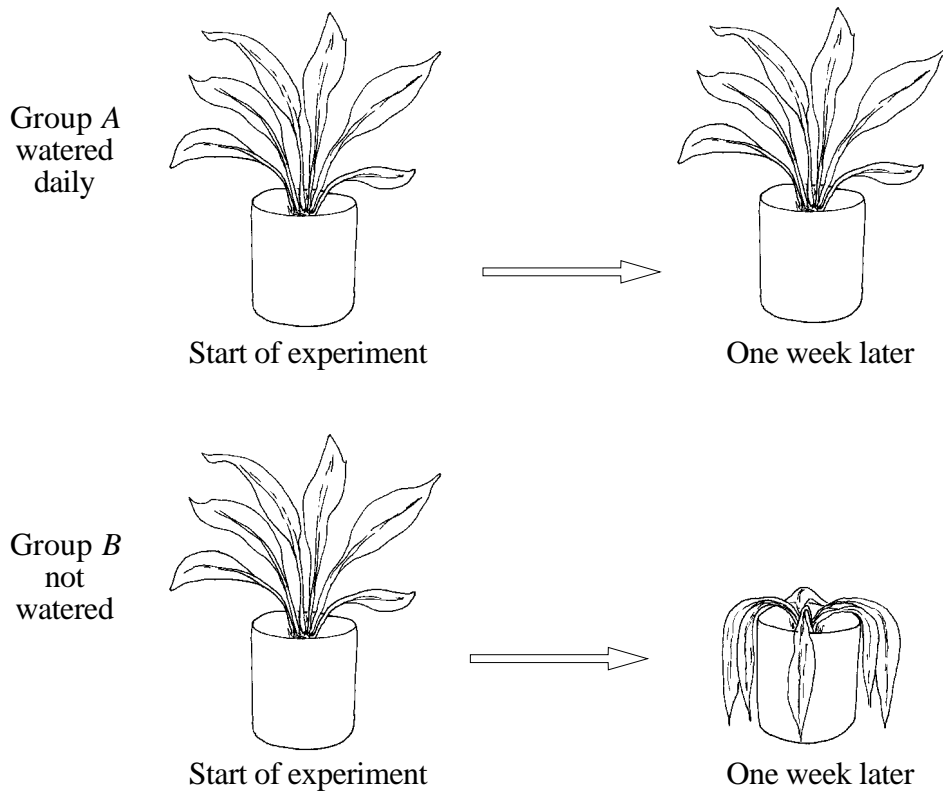
What TWO other pieces of information are required to establish that the disease was caused by the strain of bacteria?

- (b) Describe the historical development of the understanding of the causes of a disease you have studied.
29. The responses of animals to experimentally-induced infections are used as models to investigate human immunity. In an experiment to study the immune response of rabbits to a strain of bacteria, a small sample of the bacteria was injected into a group of rabbits at X. Blood samples were drawn from the rabbits at regular time intervals for the analysis of antibody levels. The results of these measurements are shown in the graph below.



- (a) Describe the changes in antibody levels over time after the bacteria were injected.
- (b) Complete the graph in the Answer Book to show how the antibody levels would change if a second injection of bacteria were given at Y.
- (c) Explain the shape of the curve you drew in part (b).
- (d) Can the antibodies produced in response to the injection at X be used to combat different bacteria that can infect these rabbits? Explain your answer.
- (e) Apart from antibody production, describe ONE other way by which the immune system can fight bacterial infections.

30. In an experiment investigating the role of water in plants, two groups of potted plants were used. Group A plants were watered every day for a week, and Group B plants received no water for a week. The diagram below shows what happened to typical Group A and Group B plants during the experiment.



- What was the role of Group A in this experiment?
 - Explain why the appearance of the Group B plants changed during the experiment.
 - Draw a typical photosynthetic cell from a Group B plant at the end of the experiment.
 - Desert plants are able to survive for long periods without water. Describe TWO adaptations of desert plants which allow them to do this.
31. In the fruit fly *Drosophila melanogaster*, one gene determines hairiness and another determines body colour. When a pure-breeding hairy fly with black body is mated to a pure-breeding hairless fly with grey body, all the flies produced in the next generation (F_1) have hairy grey bodies.
- Which character, black body or grey body, is recessive? Explain your answer.
 - An individual from the F_1 generation is crossed with a hairless parent. What proportion of hairy flies (regardless of body colour) would you expect? Show all working.
 - If the F_1 are allowed to mate among themselves, what proportion of their offspring will have the same phenotype as the F_1 ? Show all working.

SECTION II—ELECTIVES

(25 Marks)

Attempt ONE question.

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

	Page
The Australian Environment	14
Structure and Function of Cells and Tissues	17
Control and Coordination	19
Classification and the Species Concept	23
The Human Species	25
Genes in Action	28
Human Environmental Impact	30

QUESTION 32. The Australian Environment**Marks**

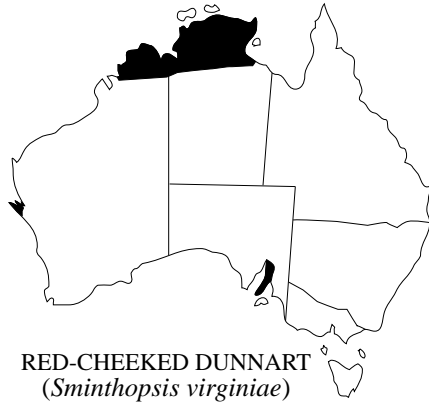
- (a) (i) Outline the theory of continental drift. **4**
- (ii) Describe how this theory helps to explain the past and present distribution of organisms on the world's continents, using an example of an Australian organism.
- (iii) There is evidence that Australia's present climate is quite different from climatic conditions in the past. Explain how continental drift has led to this climatic change.
- (b) (i) Name a species that has been introduced into Australia. **3**
- (ii) Describe TWO effects that this introduced species has on the environment.
- (iii) Eucalypts have been extensively planted in other parts of the world, and in some countries they have become a pest. Suggest ONE reason why they have become a pest.
- (c) Imagine that you are about to set out to study an ecosystem. Before you begin, you will have to plan carefully how to go about this task. **9**
- (i) First, decide on which ecosystem you wish to study. Name this ecosystem.
- (ii) If you wish to study the abundance of organisms, you will have to select the most appropriate technique. Name ONE species in your ecosystem that is best studied using quadrats. Explain why this is the most appropriate method for this species.
- (iii) Physical and chemical factors are important in determining species distribution. Name ONE physical and ONE chemical component of your ecosystem. Discuss the effect each component has on the distribution of a named species in the ecosystem.
- (iv) Because there will be many species in your ecosystem, relationships between species will be an important aspect to study. List TWO types of relationships that you would expect to find in your ecosystem. Give an example of each type, using species present in the ecosystem.
- (v) You may also be interested in the life cycles of selected species in your ecosystem. Name a species present in the ecosystem. Describe how you would go about studying the life cycle of that species.
- (vi) Your final task before you set off is to assemble all the equipment and other things that will be required to undertake your study. List SIX items that you will need to take with you. Explain what each item will be used for.

QUESTION 32. (Continued)

Marks

- (d) Dunnarts are mouse-size marsupials found only in Australia and nearby islands. They are active and aggressive hunters, eating insects, spiders, centipedes, and occasionally, small reptiles. Distribution maps of four dunnart species are shown below. 5

'Key guide to Australian mammals', L Cronin, Reed Books 1991, pp32+34.



- (i) Describe TWO climatic differences between the habitats of *Sminthopsis virginiae* and *Sminthopsis leucopus*.
- (ii) Suggest TWO possible reasons why *Sminthopsis crassicaudata* is more widespread than *Sminthopsis granulipes*.
- (iii) The distribution of *Sminthopsis leucopus* is smaller now than it was 80 years ago. Suggest TWO possible reasons why this has happened.
- (iv) A fifth species, the Hairy-footed Dunnart (*Sminthopsis hirtipes*), is found on sandhills of the Western Australian deserts. Suggest a reason why these dunnarts have long, broad feet and a fringe of hairs between the toes.
- (v) Which method would be the most suitable for studying the abundance of dunnarts? Explain your answer.

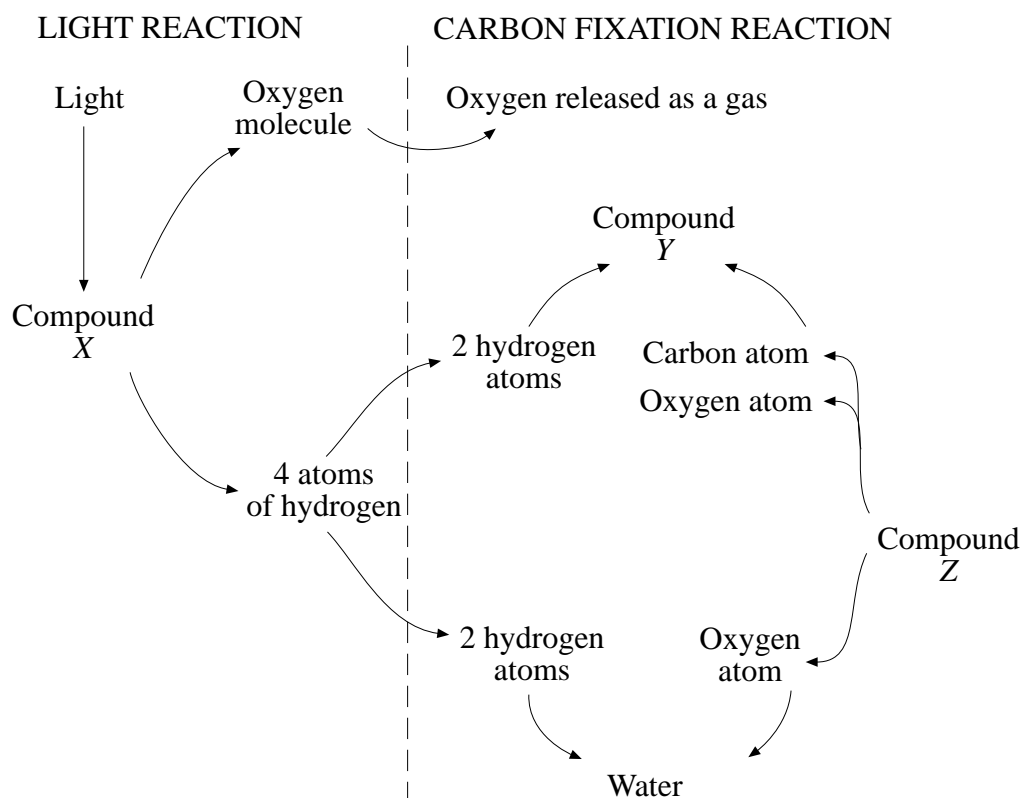
QUESTION 32. (Continued)

Marks

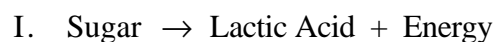
- (e) In this Elective, you studied the distribution of selected indigenous plants and animals in Australia, and the reasons behind these distribution patterns. **4**
- (i) Name ONE indigenous plant species, including the name of the family to which this species belongs.
 - (ii) Describe the present distribution of the species named in part (i). You may provide a map to show distribution if you wish.
 - (iii) Explain how the distribution of the species named above has been changed by human activities.
 - (iv) As a result of the build-up of greenhouse gases in the atmosphere, some scientists predict that the Earth's climate will get warmer in the next few decades. What effect would you expect this global warming to have on the distribution of the species named above?

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

- (a) Below is a greatly simplified diagram of the light reaction and carbon fixation reaction. **5**



- Name the process summarised in the diagram.
 - Where in the chloroplast does the light reaction occur?
 - Name the compounds X, Y, Z in the above diagram.
 - Plants have sometimes been called 'energy converters'. Briefly discuss this statement.
- (b) Below are word equations that describe two forms of respiration. **4**

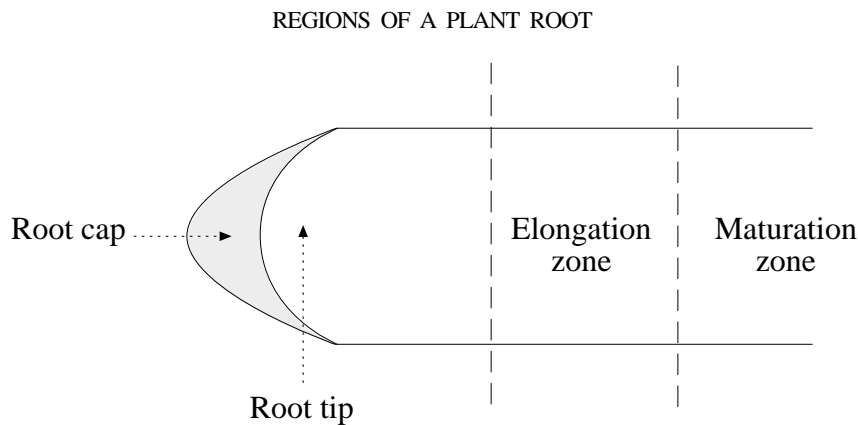


- Outline one biochemical pathway which is common to both forms of respiration.
- State how many molecules of ATP are produced by each of the two forms of respiration.
- Name the site(s) in the cell where processes I and II take place.

QUESTION 33. (Continued)

Marks

- (c) (i) Draw a mitochondrion as seen under the electron microscope. 3
- (ii) Label THREE features apparent at this magnification.
- (iii) Indicate where the reactions of the cytochrome chain occur in the mitochondrion.
- (d) A diagram of a plant root under low magnification is shown below. 5

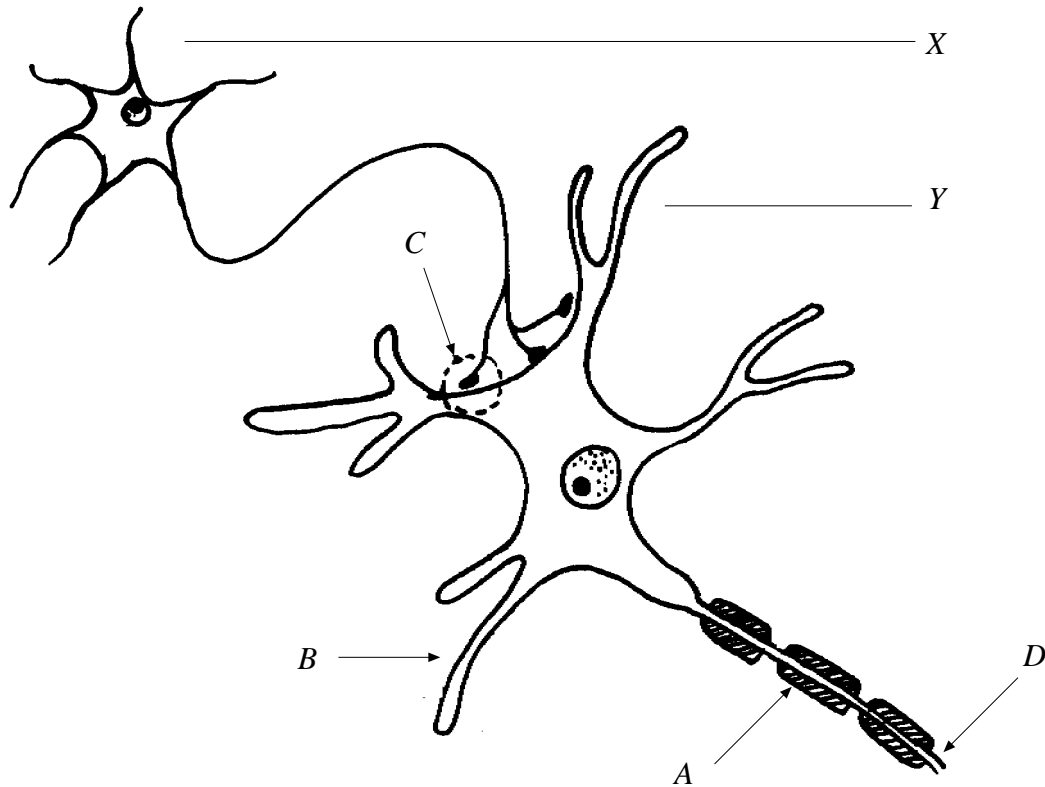


'Biology Today', Wilkinson & Nash, Macmillan Education Australia 1989. p.16.

- (i) In which region would most cell division be occurring?
- (ii) What is the function of the root cap?
- (iii) Draw a section from the root tip as it would appear under the light microscope. Label features that would enable you to distinguish this tissue from that found in the maturation zone.
- (e) (i) Most enzymes are highly specific in their action. Explain this specificity in terms of the biochemical structure of enzyme molecules. 4
- (ii) Some anti-bacterial drugs work by inhibiting an enzyme found in bacteria. Suggest ONE similarity and ONE difference that you would expect to find between the natural substrate for the enzyme and the anti-bacterial drug.
- (f) Name a specialised animal tissue you have studied. Describe THREE structures related to the specialised function of this tissue. 4

QUESTION 34. Control and Coordination**Marks**

- (a) The diagram below shows a motor neuron (*Y*) and an interneuron (*X*) in the spinal cord. **5**



- (i) Name the structures labelled:

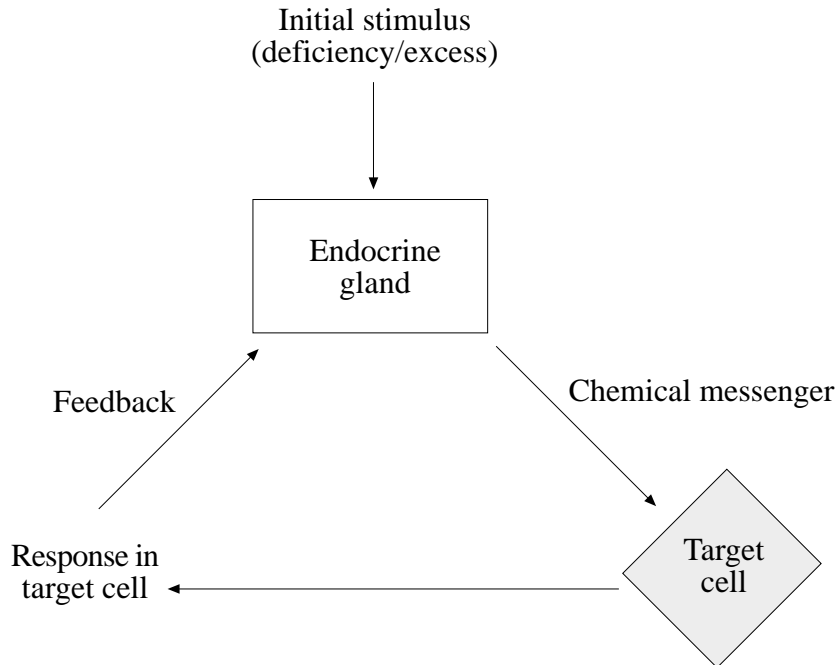
1. *A*
2. *B*
3. *C*
4. *D*.

- (ii) Outline the function of the structure labelled *A*.
- (iii) Outline the function of the structure labelled *C*.
- (iv) Explain why nerve impulses do not pass from neuron *Y* to neuron *X*.
- (v) Name an effector cell that would receive nerve impulses from neuron *Y*.

QUESTION 34. (Continued)

Marks

- (b) The model below illustrates the process of feedback control in the endocrine system. 5



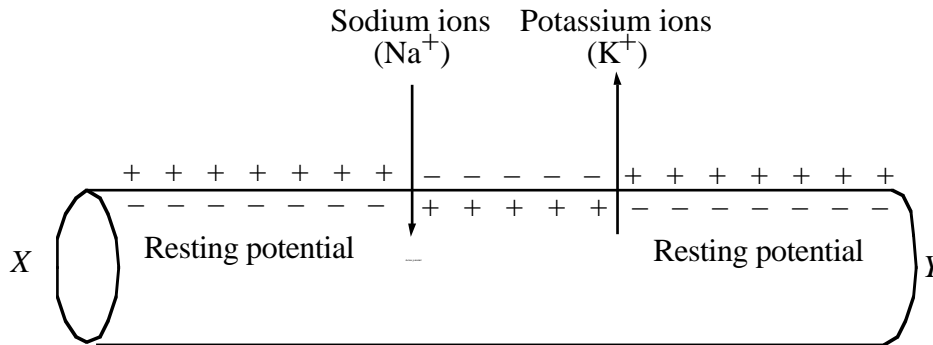
You have studied a system which displays this type of feedback control.

- (i) For the system you have studied, name the:
1. endocrine gland(s);
 2. target cell involved;
 3. chemical messenger released.
- (ii) Describe the response in the target cell and the effect of the feedback on the endocrine gland.
- (iii) Why do these chemical messenger molecules interact specifically with the target cell and not with other cell types?

QUESTION 34. (Continued)

Marks

- (c) The diagram below shows a nerve impulse travelling along a nerve fibre. The arrows represent the direction of the flow of ions across the membrane. 3

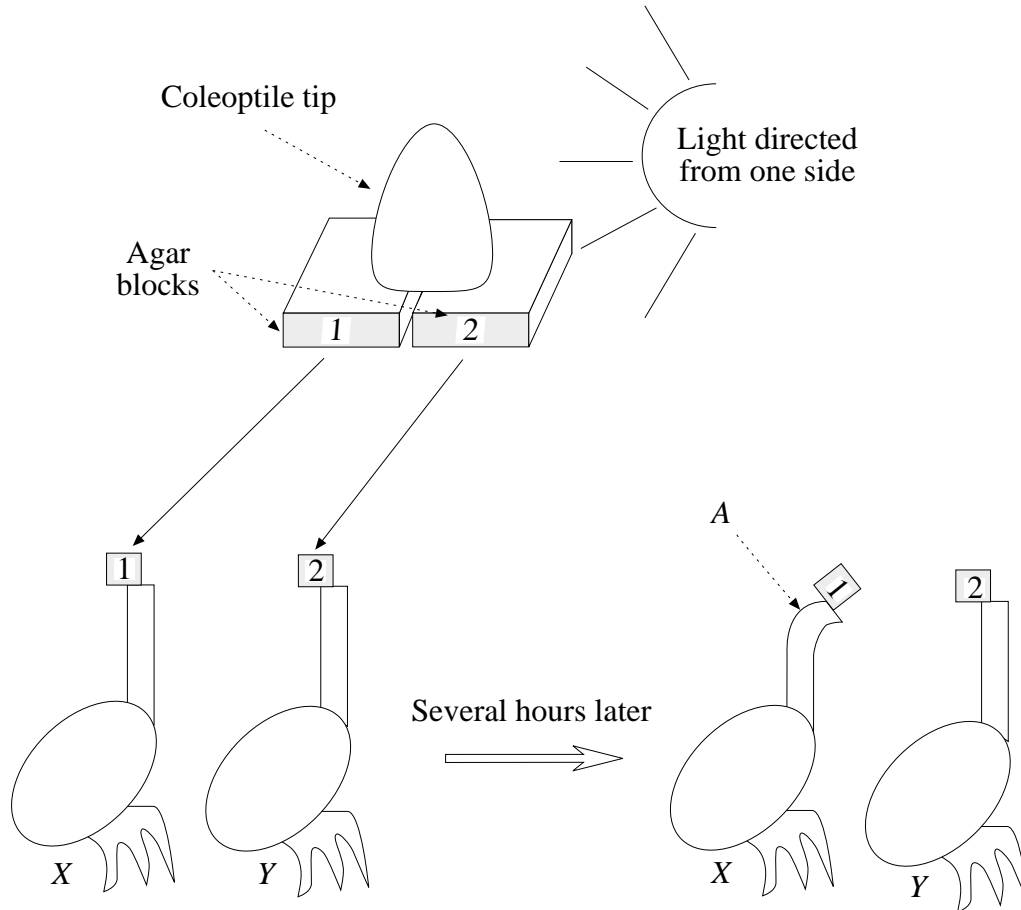


- (i) Is the impulse travelling towards X or Y?
- (ii) What process maintains the resting potential following nerve activity?
- (iii) The 'all-or-nothing' rule states that all nerve impulses are of equal size. How, therefore, can stimuli of differing strengths be distinguished from one another?
- (d) Select ONE specialised sensory organ that you have studied which responds to light or sound stimuli. 3
- (i) Name the specialised cells that convert the stimuli into nerve impulses in that organ.
- (ii) Where in that organ are these specialised cells found?
- (iii) Name TWO other structures that contribute to the function of this sensory organ.
- (e) (i) List TWO *differences* and TWO *similarities* between the nervous and endocrine systems. 3
- (ii) Give an example of an organ whose function is controlled by both the nervous and endocrine systems. Describe the effect of each system on this organ.
- (f) (i) Name TWO plant hormones. 3
- (ii) For each hormone, describe a stimulus that would promote its production.
- (iii) For each hormone, name the region of the plant in which the hormone has its major effects.
- (iv) Describe the major effects of each hormone.

QUESTION 34. (Continued)

Marks

- (g) The diagram below shows an experiment on the growth of coleoptile tips from seedlings. 3



Test coleoptiles (tips removed)

- (i) Explain why coleoptile X bends more than coleoptile Y.
- (ii) Describe what happens to the cells in the stem of coleoptile X at point A on the diagram.
- (iii) Name the plant response being investigated in this experiment.
- (iv) What is an advantage of this response to growing plants?

- | QUESTION 35. Classification and the Species Concept | Marks |
|--|--------------|
| <p>(a) Common brushtail possums inhabit forests and woodlands along the entire east coast of Australia. Possums from the rainforests of north Queensland have copper-coloured fur, while those from Tasmania are dark grey or black. In New South Wales and Victoria the fur colour is typically a light brownish-grey.</p> <p>(i) Explain how variation in fur colour has arisen in brushtail possums.</p> <p>(ii) The three colour variants are assumed to belong to the same species. What evidence is needed to prove that this assumption is correct?</p> <p>(iii) Given sufficient time, the Tasmanian possum could develop into a separate species. Describe the role of isolation in this process.</p> | 4 |
| <p>(b) (i) Explain the organisation of hierarchical classification systems.</p> <p>(ii) Explain why such systems for classifying organisms are useful to scientists.</p> <p>(iii) List the categories used in biological classification schemes. Your list should begin at the species level and be in the correct order.</p> | 4 |
| <p>(c) (i) 1. Explain what is meant by the 'binomial system of naming organisms'.</p> <p>2. Outline the advantages of the binomial naming system over the use of common names.</p> <p>(ii) The scientific names of three organisms are shown below:</p> <ul style="list-style-type: none"> • <i>Hedera helix</i> • <i>Hedera canariensis</i> • <i>Helix pomatia</i>. <p>Use your knowledge of the binomial system of naming organisms to describe the relationship between the organisms:</p> <p>1. <i>Hedera helix</i> and <i>Hedera canariensis</i>;</p> <p>2. <i>Hedera helix</i> and <i>Helix pomatia</i>.</p> | 4 |

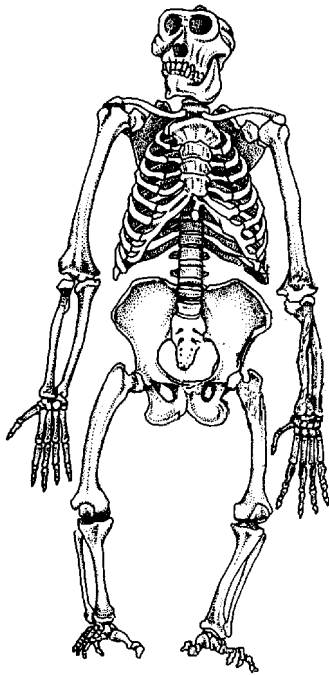
QUESTION 35. (Continued)

Marks

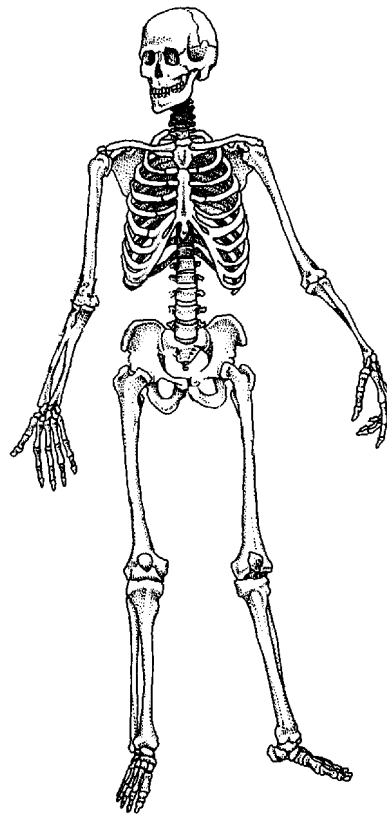
- (d) In this Elective you studied the characteristics used to classify animals to the order level, using insects as examples. **4**
- (i) Describe the characteristics that distinguish animals from other living organisms.
 - (ii) Name the TWO orders of insects that you have studied.
 - (iii) List THREE characteristics that are common to both orders.
 - (iv) List THREE characteristics that can be used to distinguish the two orders.
- (e) **4**
- (i) Name a plant family that you have studied.
 - (ii) List TWO characteristics that are used to classify plants into this family.
 - (iii) Name a genus belonging to this family.
 - (iv) Give the scientific names of TWO plant species from this family.
 - (v) Describe TWO characteristics that can be used to distinguish the two species of plants you named above.
- (f) **5**
- (i) Define the term 'cline'. Use a named plant or animal to illustrate your answer.
 - (ii) Suggest ONE environmental feature that may have contributed to the establishment of the cline you described in part (i).
 - (iii) Are environmental factors alone sufficient to establish a cline? Explain your answer.
 - (iv) What is the role of clines in the speciation process?
 - (v) Outline the role of genetic change in the speciation process.

QUESTION 36. The Human Species**Marks**

- (a) Cats, horses, monkeys, and humans are all classified by scientists as mammals. **3**
- Outline TWO characteristics that these mammals share with all other animals.
 - List TWO characteristics that could be used to classify these four animals as mammals.
 - Name TWO *physical features* that humans share with monkeys, but not with cats and dogs.
- (b) Below are diagrams of a gorilla skeleton and a human skeleton. **6**



GORILLA SKELETON



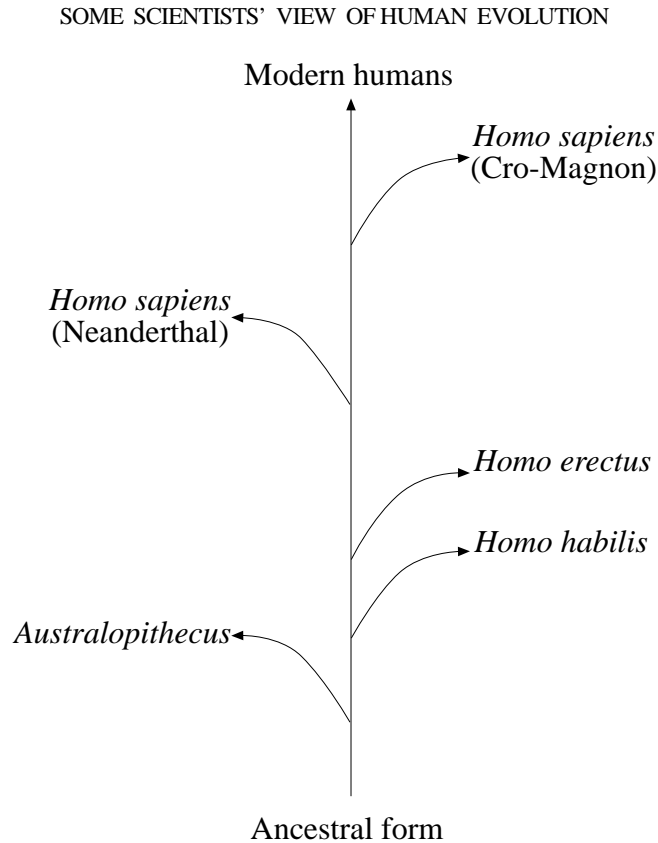
HUMAN SKELETON

- List THREE skeletal differences that have assisted humans to move with a striding upright gait.
- Describe how each of these features has been of assistance in achieving an upright stance.
- List TWO other features that could be used as evidence in determining if a skeleton was that of a gorilla or a human.
- Name THREE non-structural characteristics of humans that distinguish them from other living primates.

QUESTION 36. (Continued)

Marks

- (c) A number of theories outlining human evolution have been put forward by scientists. Below is one possible evolutionary pathway. 4



- (i) Briefly outline TWO pieces of evidence that scientists have used to develop theories of human evolution.
- (ii) Give ONE reason why different theories of human evolution have developed based on the same evidence.
- (iii) Detail TWO pieces of evidence that scientists could use to distinguish between complete specimens of *Homo habilis* and *Homo erectus*.
- (d) (i) The biological evolution of humans has contributed to human cultural development. Give TWO examples of this process. 4
- (ii) 1. Describe TWO forms of evidence that palaeontologists could use to study Aboriginal cultural development during the past 40 000 years.
2. Describe ONE limitation of interpreting past Aboriginal culture from archaeological and palaeontological evidence alone.

QUESTION 36. (Continued)

Marks

- (e) Members of *Homo sapiens* in different regions of the world have different physical characteristics. **4**
- (i) Give TWO examples of such physical differences, and outline the possible adaptive advantages of each.
 - (ii) 'It is difficult to sustain the concept of race.'
- Use an example you have studied to support or refute this statement.
- (f) For *each* of the following, use ONE example to explain how humans have the potential to influence their own evolution through: **4**
- (i) technology;
 - (ii) agriculture;
 - (iii) genetic techniques;
 - (iv) birth control.

QUESTION 37. Genes in Action**Marks**

- (a) The table below shows some of the DNA codes for a group of amino acids. Each amino acid is identified by a sequence of three DNA bases known as a DNA triplet or codon. 4

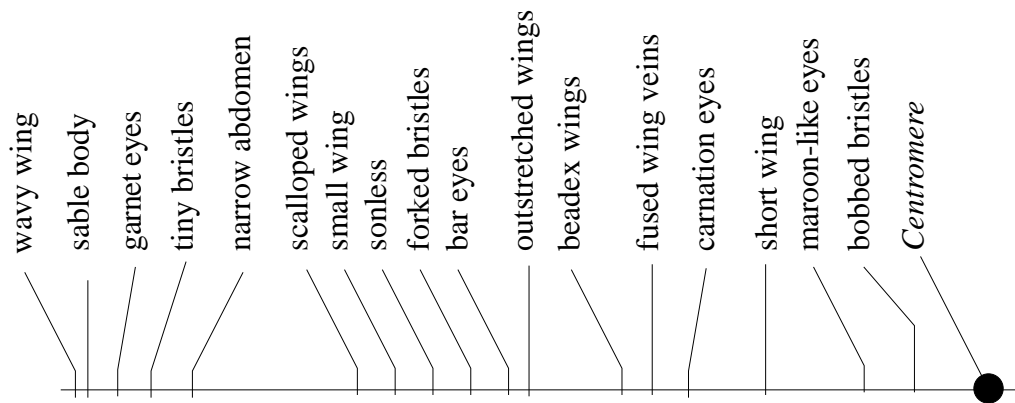
<i>DNA triplet</i>	<i>Amino acid</i>	<i>DNA triplet</i>	<i>Amino acid</i>
CGA	Alanine	AAT	Leucine
GCA	Arginine	TTT	Lysine
TTA	Asparagine	TAC	Methionine
CTA	Aspartic acid	AAA	Phenylalanine
ACA	Cysteine	GGA	Proline
CTT	Glutamic acid	AGA	Serine
GTT	Glutamine	TGG	Threonine
CCA	Glycine	ACC	Tryptophan
GTA	Histidine	ATA	Tyrosine
TAA	Isoleucine	CAA	Valine

- (i) Explain why three bases, rather than one or two bases, are needed to code for a single amino acid.
- (ii) List, in order, the sequence of amino acids specified by the following DNA strand:
- CCATACAATGTT
- (iii) Give the tRNA code for the amino acid, proline.
- (b) (i) Outline the role of mRNA in protein synthesis. 4
- (ii) Outline the role of the ribosome in protein synthesis.
- (c) (i) One form of gene mutation is caused by the addition of an extra base pair to a gene. 5
1. Name this form of gene mutation.
 2. Outline the possible effects of this mutation.
 3. Name one other type of gene mutation.
- (ii) Name ONE form of chromosomal mutation, and briefly outline the effects that this mutation has on the phenotype of the organism.
- (iii) List TWO environmental agents that can increase the rate of mutation in animal cells.

QUESTION 37. (Continued)

Marks

- (d) Egg weight in poultry is an example of a polygenic trait. 3
- (i) Explain the variation of egg weight in terms of polygenic inheritance.
- (ii) Name one human characteristic which is the result of polygenic inheritance.
- (e) Shown below is a gene map for the X-chromosome of the fruit fly *Drosophila melanogaster*. 2



Explain how geneticists were able to work out the position of each gene, and the relative distance between the genes.

- (f) The gene controlling the human ABO blood group has three alleles I^A , I^B , and I^O . 2
- (i) List all the possible genotypes of blood group A and blood group O.
- (ii) What are the possible blood groups of a child whose mother is group A and father is group O? Show all working.
- (g) (i) The manipulation of genes through techniques such as genetic engineering has raised some serious ethical issues in the general community. 5
1. Describe ONE of these issues.
 2. Describe ONE way in which scientists can effectively respond to these community concerns.
- (ii) Genetic manipulation has led to the development of a new process for the production of human insulin.
1. Describe this process.
 2. Discuss the advantages and disadvantages of this development.

QUESTION 38. Human Environmental Impact	Marks
(a) Changes in human activity over the past 10 000 years have profoundly affected human population numbers. Name TWO important changes in activity, and explain how these changes altered human population numbers.	3
(b) (i) What is meant by the term 'heavy metals'?	3
(ii) Outline ONE use of heavy metals in modern society.	
(iii) Give an example of a harmful effect caused by heavy metals in modern society.	
(c) Select ONE of these wastes:	2
• garbage	
• sewage	
• heavy metals.	
(i) Describe a method employed in its disposal.	
(ii) Does the method you have described pose any threat to the environment? Explain.	
(d) (i) What is meant by the term 'endangered species'?	3
(ii) Describe an example of human activity resulting in a change in the population numbers of an endangered species.	
(e) (i) Define the terms 'controlled burning' and 'accidental fire'.	4
(ii) List THREE differences between the effects of controlled burning and accidental fires on native forest.	
(f) (i) Discuss the effects of resource exploitation and redistribution on ONE of the following:	6
• forests	
• the supply of minerals	
• the genetic composition of wild populations.	
(ii) Define the phrase 'resource stripping'.	
(iii) Give an example of resource stripping, and describe its environmental and economic effects.	
(iv) Use examples to distinguish between renewable and non-renewable resources.	

QUESTION 38. (Continued)

Marks

- (g) (i) Name a species that has been introduced into Australia. **4**
- (ii) Describe TWO effects that this introduced species has had on native flora or fauna.
- (iii) Outline methods that have been used to control the numbers and distribution of this species.
- (iv) Comment on the success or otherwise of the methods of control of this species.

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