BOARD OF STUDIES
NEW SOUTH WALES

HIGHER SCHOOL CERTIFICATE EXAMINATION

1995

BIOLOGY

2 UNIT

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

DIRECTIONS TO CANDIDATES

Section I—Core

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

Section II—Electives

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

SECTION I—CORE

(75 Marks)

Attempt ALL questions.

PART A

Questions 1–15 are worth 1 mark each.

Mark your answers in pencil on the Answer Sheet provided.

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

1. The current estimate of the age of the Earth is an important piece of evidence supporting the theory of evolution. The current estimate is

(A) 6500 years.

(B) 650 million years.

(C) 5 billion years.

(D) 50 billion years.

2. The following gametes are produced by two different parents.

Parent 1: GM, Gm, gM, gm

Parent 2: gm, gm, gm, gm

The genotypes of parent 1 and parent 2 would be

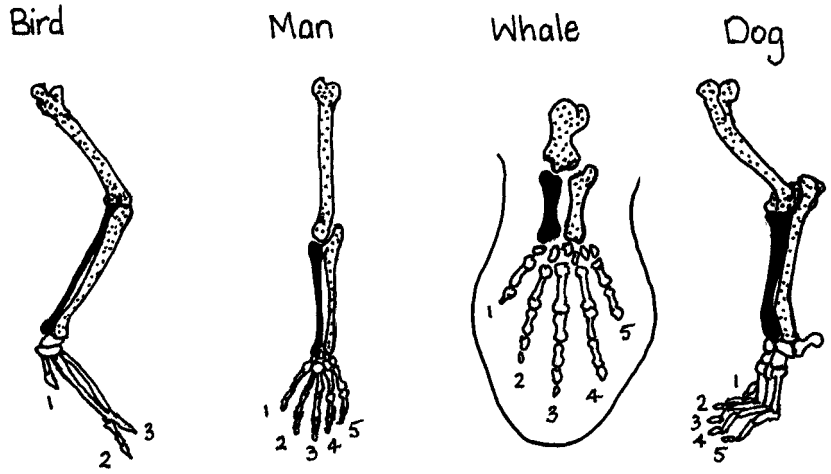
(A) GgMm and GgMm.

(B) Ggmm and ggmm.

(C) GgMM and ggmm.

(G) GgMm and ggmm.

3. The bone structure of the forelimbs of four different vertebrates is shown below.



Each of these limbs shows the same basic pattern. This has been caused by

(A) adaptation to similar environments.
(B) all the vertebrates belonging to the same species.
(C) evolution from a common ancestor.
(D) adaptation to the same basic function.

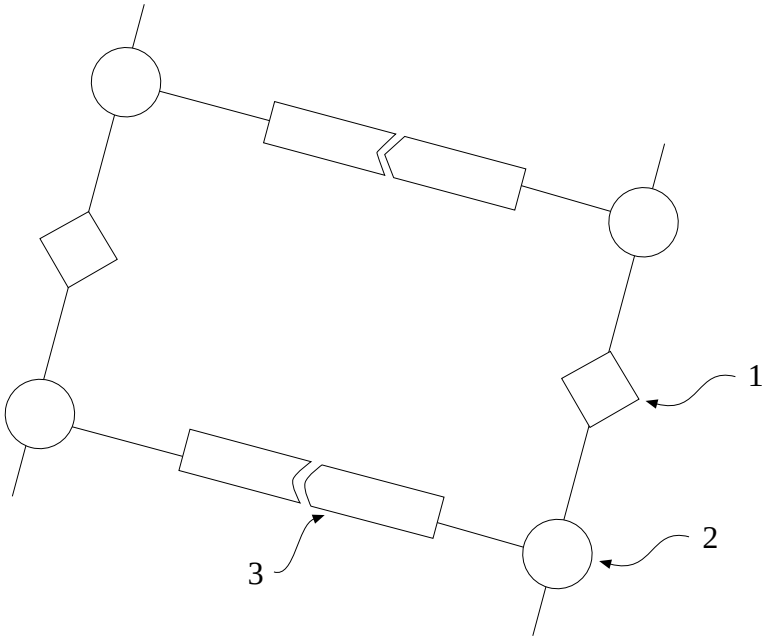
4. Twenty per cent (20%) of the nucleotide bases in human DNA are guanine (G). What is the percentage of adenine (A) bases in human DNA?

(A) 20
(B) 30
(C) 40
(D) 80

5. Natural selection will NOT change the frequency of a genetic disease that

(A) affects the survival of a foetus.
(B) reduces the production of sperm.
(C) is expressed after reproductive age.
(D) affects the mating behaviour of an organism.

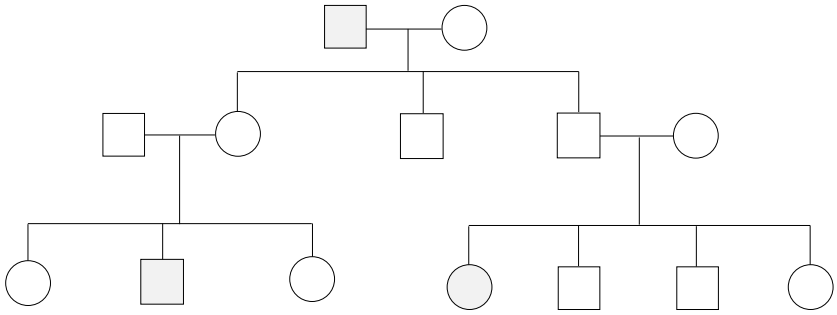
6. The diagram below shows a simplified model of a part of a DNA molecule.



The parts labelled 1, 2, and 3 are respectively

(A) nucleotide base, phosphate group, and sugar molecule.
(B) nucleotide base, sugar molecule, and phosphate group.
(C) phosphate group, nucleotide base, and sugar molecule.
(D) phosphate group, sugar molecule, and nucleotide base.

7. The family tree below shows the inheritance of a disease in a human family.



KEY

normal female

normal male

affected female

affected male

This inherited disease is

(A) sex-linked and dominant.

(B) sex-linked and recessive.

(C) not sex-linked and dominant.

(D) not sex-linked and recessive.

8. In which of these examples would you expect to find two *different* sets of genetic information?

(A) Two muscle cells, one in each of two identical (monozygotic) twins.

(B) Two nerve cells in the same person.

(C) Two ova in the same person.

(D) A liver cell and a skin cell in the same person.

9. Phytoplankton are microscopic photosynthetic organisms found in aquatic environments. They are usually found in the top few metres of water because

(A) they have no swimming-organs.

(B) water is warmest in the top layers.

(C) light does not penetrate far into water.

(D) the viscosity of water prevents them from sinking to the bottom.

10. The salt content of sea water is 3·5%, while the body fluids of fish contain about 1·1% salt. This means that the tissues of fish living in sea water tend to

(A) lose water and gain salts.

(B) lose both water and salts.

(C) gain water and lose salts.

(D) gain both water and salts.

11. If plants are not watered in dry weather, the leaves tend to droop. This happens because

(A) the plant cell walls become softer as they dry out.

(B) salts accumulate within the plant and poison the leaves.

(C) water enters the leaves and the stems cannot support the increased weight.

(D) water is lost from cells and the cytoplasm shrinks away from the cell wall.

12. Plants growing in desert conditions often have small leaves with small stomata. These adaptations

(A) reduce transpiration.

(B) prevent sunburn of the leaf.

(C) increase the rate of photosynthesis.

(D) make the leaf unappetizing to animals.

13. Unicellular organisms rarely grow larger than 1 mm in diameter. Beyond this size,

(A) cells become visible to predators.

(B) it is not possible for mitosis to occur.

(C) cell membranes begin to disintegrate.

(D) diffusion alone is not adequate for nutrient supply.

14. When a bacterium enters the bloodstream of a mammal it acts as

(A) a B-cell.

(B) a T-cell.

(C) an antigen.

(D) an antibody.

15. A role of phagocytes in the human body is to

(A) manufacture antigens.

(B) engulf micro-organisms.

(C) destroy antibodies.

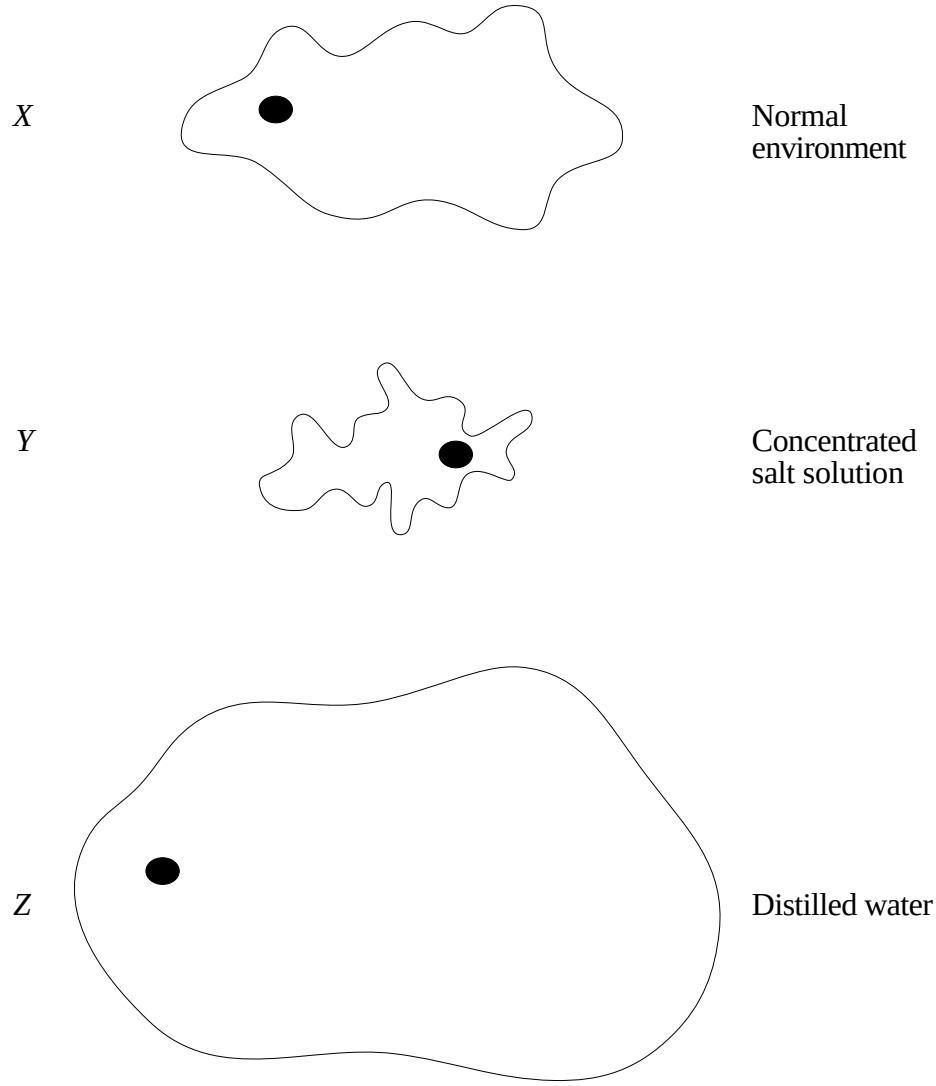
(D) produce T-lymphocytes.

PART B

Questions 16–25 are worth 3 marks each.

Answer this Part in the Part B Answer Book.

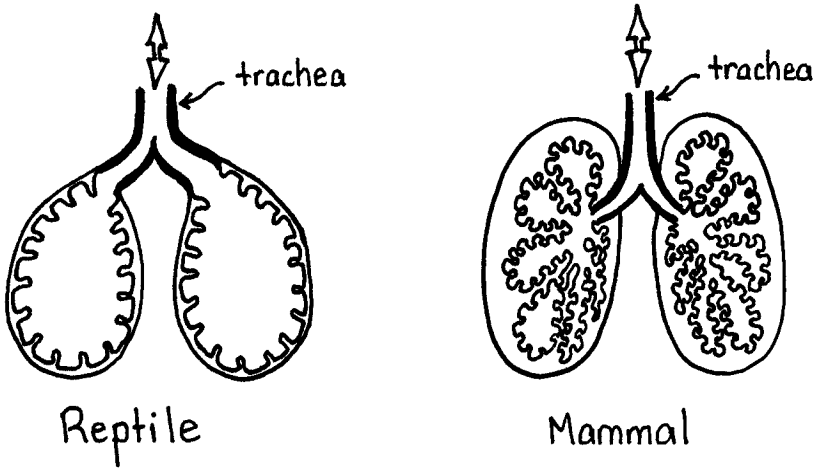
16. An amoeba is a unicellular organism that lives in aquatic environments. The diagram below shows the same amoeba in three different aquatic environments.



(a) Name the process responsible for the swelling of the amoeba in *Z*.

(b) Describe TWO adaptations of *multicellular* animals to aquatic environments that have a high salt content similar to the environment shown in *Y*.

17. The diagrams below illustrate the respiratory surfaces found in two different terrestrial vertebrates.



(a) Name TWO functions of these respiratory surfaces.

(b) Suggest ONE reason why the respiratory surface in the mammal is more complex than that in the reptile.

18. Koch postulated that a specific micro-organism could be said to cause a disease if several conditions were met. List THREE of these conditions.

19. (a) Terrestrial and aquatic environments differ in a number of aspects. Name two abiotic features that are different in the two environments.

(b) Describe TWO aspects of a seal's body shape that suit it to an aquatic environment.

20. (a) When genes are close together on the same chromosome, they are more likely to be inherited together. Explain why this occurs.

(b) In some cases, genes on the same chromosome are not inherited together. What is the advantage of this?

21. In garden peas, the allele for purple flowers (*P*) is dominant over the allele for white flowers (*p*). The allele for smooth seeds (*S*) is dominant over the allele for wrinkled seeds (*s*).

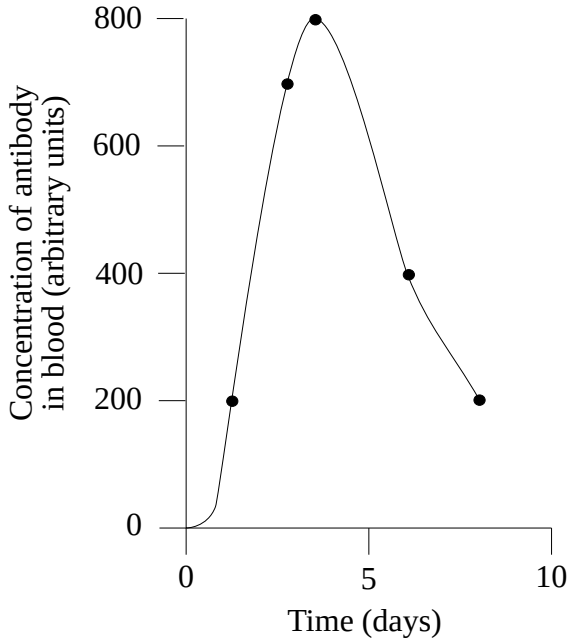
A plant that is pure breeding for purple flowers and wrinkled seeds is crossed with a plant that is pure breeding for white flowers and smooth seeds.

(a) What are the genotypes of the parent plants in this cross?

(b) Use a diagram to determine the genotypes of the offspring from this cross.

(c) Describe the phenotype or phenotypes of the offspring.

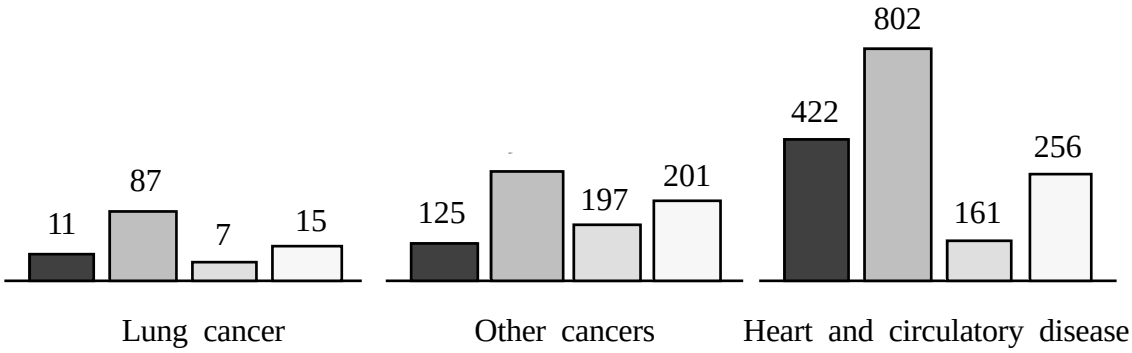
22. The following graph represents part of the body's response to infection by a pathogenic micro-organism.



(a) Explain what causes the concentration of antibody in the blood to rise sharply after the entry of the pathogen.

(b) Briefly describe the body's response to infection by the same pathogen in 6 months' time.

23. The following graphs (not to scale) show the relative numbers of deaths from various causes for people aged 45–64.



KEY

Rate per 100 000 persons.

- male non-smoker
- male smoker
- female non-smoker
- female smoker

(a) Name the most common cause of death amongst female non-smokers.

(b) Which group has the highest death rate from heart and circulatory disease?

(c) How many smokers per 100 000 died from lung cancer?

24. (a) Name ONE human disease to which resistance can be developed by immunization.

(b) Describe how immunization leads to increased resistance to the disease named in part (a) in terms of the body's immune response.

25. According to the theory of evolution, living organisms have undergone change since life arose on Earth. List THREE pieces of evidence that support this theory.

PART C

Questions 26–31 are worth 5 marks each.

Answer this Part in the Part C Answer Book.

26. As part of your practical work in Biology, you carried out an experiment to investigate the effect of the environment on the phenotypes of some organisms.

(a) Name ONE organism you studied, and describe the effects of an environmental factor on the phenotype of that organism.

(b) Describe TWO features of your experimental design that would help you to determine whether the differences in phenotype were due solely to environmental influences.

27. (a) Name ONE parasitic macroscopic animal that you have studied.

(b) Describe TWO physical characteristics of this animal that make it well suited to its environment.

(c) What effect does this parasite have on its host?

(d) Describe ONE method that could be used to control this parasite.

28. The body temperature of a reptile was measured at four-hour intervals for twenty-four hours and the following results were recorded.

Hours after noon	*Temperature* (°C)
0	32
4	29
8	28
12	18
16	12
20	25
24	32

(a) Using the grid provided in the Answer Book, draw a graph of these data to show how body temperature varies with time.

(b) On the same grid, show the body temperature of a human over the same time period.

(c) Explain any differences.

29. (a) A single gene controls flower colour in *Mirabilis* spp. A homozygous red-flowered plant is crossed with a homozygous white-flowered plant. All offspring from this cross have pink flowers.

(i) What name is given to this type of inheritance?

(ii) If one of the pink-flowered plants is crossed with a homozygous red-flowered plant, what are the possible phenotypes of the plants in the next generation?

(b) Gregor Mendel carried out successful experiments into the way the characteristics of living things are inherited. Describe THREE aspects of Mendel's experimental design that made his experiments successful.

30. The skin, respiratory surfaces, and alimentary canal are possible sites through which micro-organisms may gain entry to the human body. For each of these sites, describe the mechanisms that prevent the entry of micro-organisms.

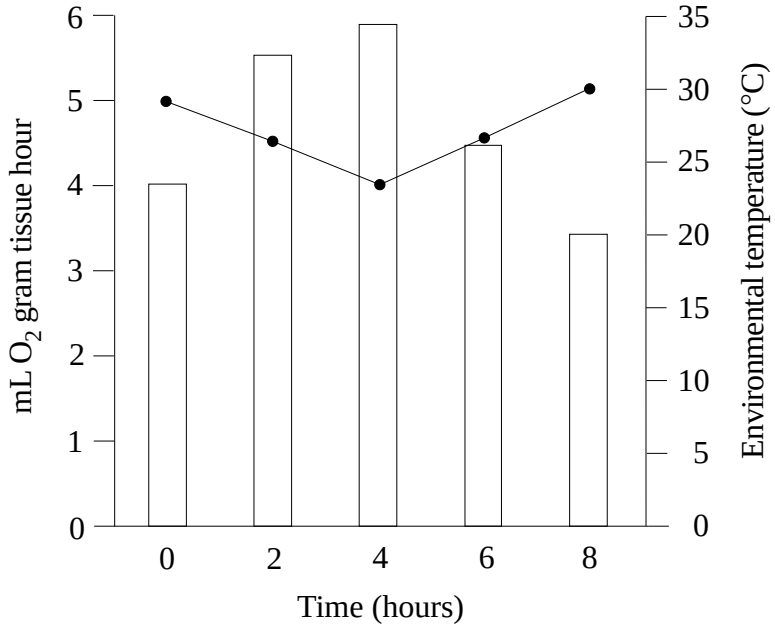
31. (a) When diving for food in Antarctic waters, penguins are able to constrict blood vessels to reduce blood flow to their extremities, such as wings and feet.

(i) State whether this is a structural, behavioural, or physiological adaptation.

(ii) Describe how this adaptation helps the penguin to survive in near freezing water.

(iii) Antarctic penguins also have a larger body mass than penguins living in temperate climates. Suggest how this might contribute to the survival of these animals in a cold climate.

(b) The bars on the graph below show the oxygen consumption of an animal during a period of eight hours. On the same graph, environmental temperature is shown as a line.



Describe the relationship between environmental temperature and the animal's oxygen consumption.

SECTION II—ELECTIVES

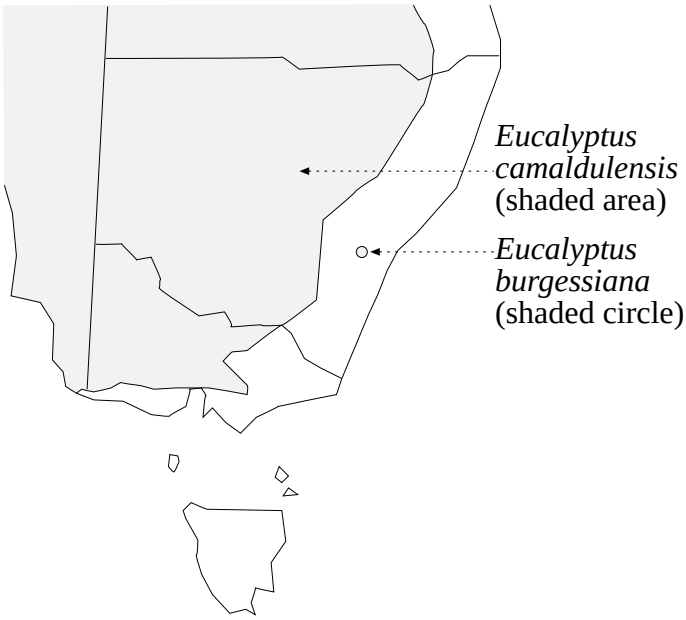
(25 Marks)

Attempt ONE question.

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

QUESTION 32. The Australian Environment **Marks**

(a) The following map shows the distribution of two *Eucalyptus* species. **3**



(i) Name TWO features of the abiotic (physical and chemical) environment that would affect the distribution of the two eucalypt species.

(ii) Give TWO possible biological factors that could account for the restricted distribution of *Eucalyptus burgessiana.*

(b) (i) Name the ecosystem you have studied. **10**

(ii) Draw the food web for the ecosystem you studied. Your food web *must* include at least FOUR organisms.

(iii) Name ONE introduced organism found in the ecosystem you studied.

(iv) Describe how this organism affects the food web of the ecosystem.

(v) Name ONE animal in this ecosystem whose life cycle you have studied.

(vi) Describe the life cycle of this animal.

(vii) Discuss the effects of TWO abiotic factors on this life cycle.

(viii) Describe ONE method that could be used to determine the abundance of this animal.

QUESTION 32. (Continued) **Marks**

(c) The southern beech (genus *Nothofagus*) is a tree of the cool-temperature rainforests of New South Wales, Victoria, and Tasmania. It also grows in New Zealand and South America. Fossil pollen of *Nothofagus* has been found in Antarctica. **3**

(i) Suggest ONE explanation for the present distribution of *Nothofagus*.

(ii) Fossil pollen of *Nothofagus* has been found in many parts of southern Australia where there are no rainforests today. What does this suggest about Australia's climate in the past?

(d) Human activity has altered the distribution and abundance of many indigenous species. **4**

(i) Describe ONE human activity and its effect on the distribution of ONE indigenous *plant* species.

(ii) Describe ONE human activity and its effect on the distribution of ONE indigenous *animal* species.

(e) (i) Name an Australian marsupial. **5**

(ii) Describe its present distribution in Australia, and explain how this distribution is related to climate.

(iii) Australia has more species of marsupials than any other continent. Suggest why this is the case, using fossil evidence to support your answer.

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

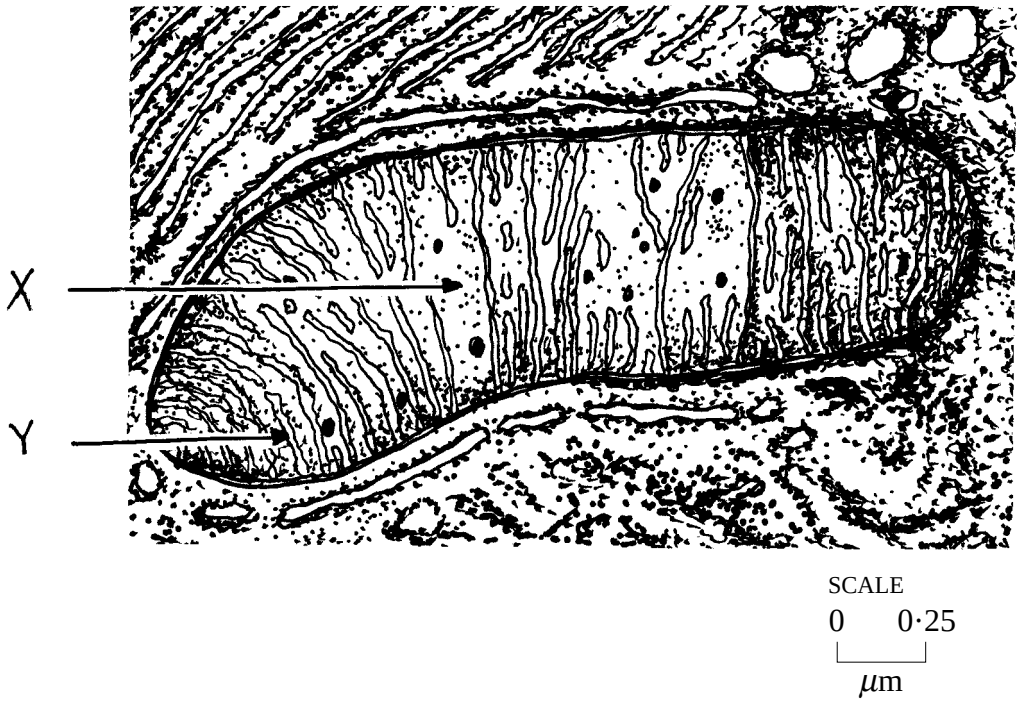
(a) (i) The process of aerobic respiration differs in many ways from the process of anaerobic respiration. List THREE differences. **6**

(ii) Glycolysis is the first stage of respiration.

1. Name the products of glycolysis.

2. Where does glycolysis occur in cells?

(iii) The diagram below shows a mitochondrion as seen under the electron microscope.



1. Name the structures labelled *X* and *Y*.

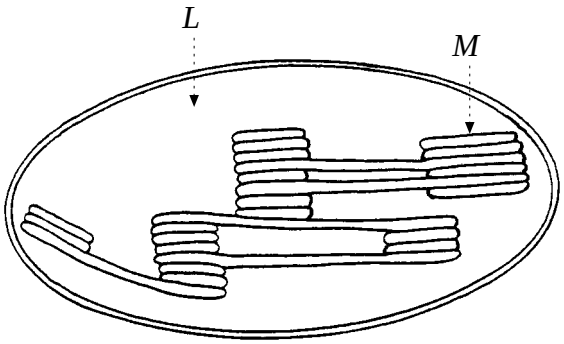
2. Which groups of enzymes are located on the structure labelled *Y*?

(b) (i) Draw a specialized tissue or cell from an animal you have studied. Label TWO features that contribute to the specialization of the tissue. **5**

(ii) Outline the functions of the two features you have labelled.

QUESTION 33. (Continued) **Marks**

(c) The diagram below represents the ultrastructure of a chloroplast. **5**



(i) Name the structures labelled *L* and *M*.

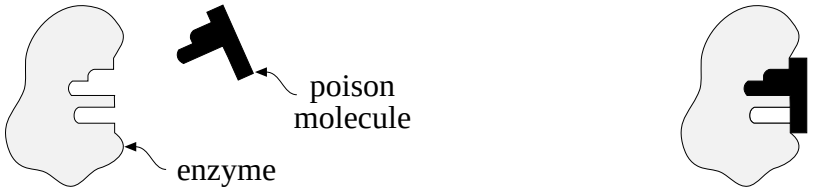
(ii) Give a brief outline of the biochemical process that occurs at *L*.

(iii) Give a brief outline of the biochemical process that occurs at *M*.

(d) Name a unicellular organism you have studied. Name TWO specialized structures and explain the function of each of these structures. **4**

(e) (i) Why are enzymes important in cell metabolism? **5**

(ii) Some pesticides and nerve gases produce their toxic effects by inhibiting enzyme activity. This inhibition is caused by the poison linking to a specific part of the enzyme molecule as shown in the diagram below.



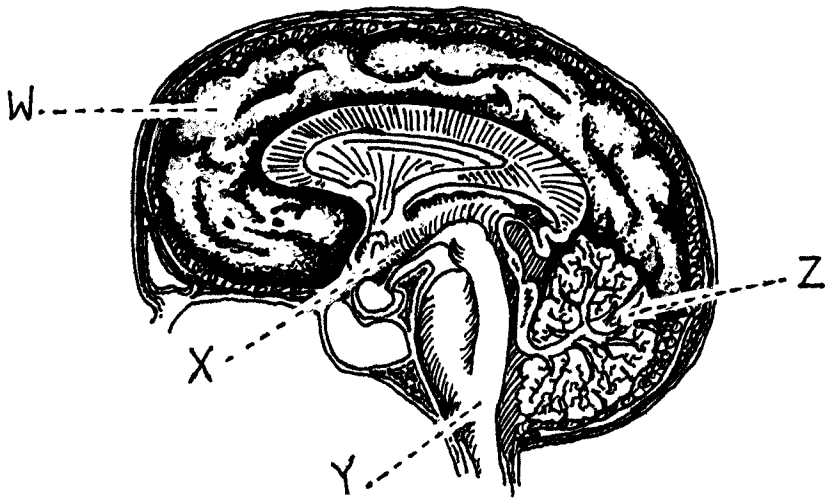
Explain why the linking of the enzyme and poison molecule inhibits the activity of the enzyme.

(iii) Most enzymes when exposed to excessive heat permanently lose their ability to catalyse specific metabolic reactions.

Explain why this occurs.

QUESTION 34. Control and Coordination **Marks**

(a) The diagram below shows the mammalian brain. **4**



(i) Name the structures marked:

1. *W*
2. *X*
3. *Y*
4. *Z*.

(ii) State ONE function of each of the named structures.

(b) (i) Name ONE hormone secreted by the pituitary gland. **6**

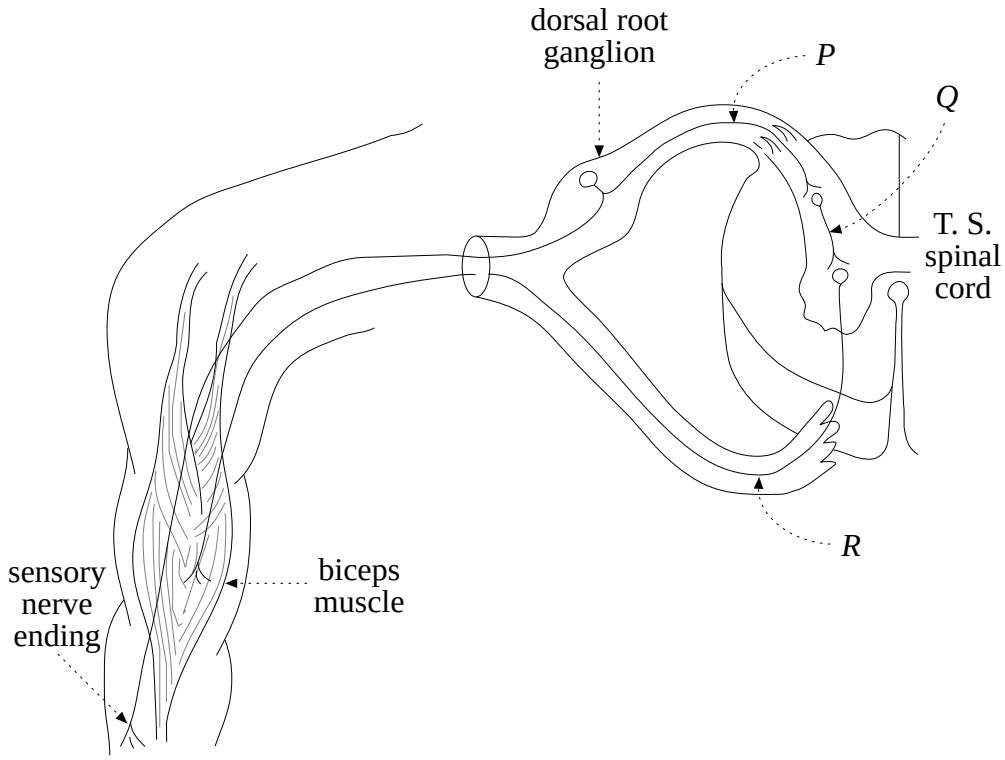
(ii) Name the organ(s) on which the hormone named in part (b) (i) above acts.

(iii) What feature of the cells of the organ(s) named in part (b) (ii) above enables them to respond to the hormone?

(iv) Explain the relationship between the hypothalamus and the pituitary gland.

QUESTION 34. (Continued) **Marks**

(c) The diagram below shows the structures involved in a simple withdrawal reflex in a mammal (e.g. withdrawal of the hand after touching a hot object). **5**



(i) Each of the neurons (*P*, *Q*, *R*) has a different function. What names are given to:

1. *P*?

2. *Q*?

3. *R*?

(ii) Which structure in the diagram is the effector in this reflex?

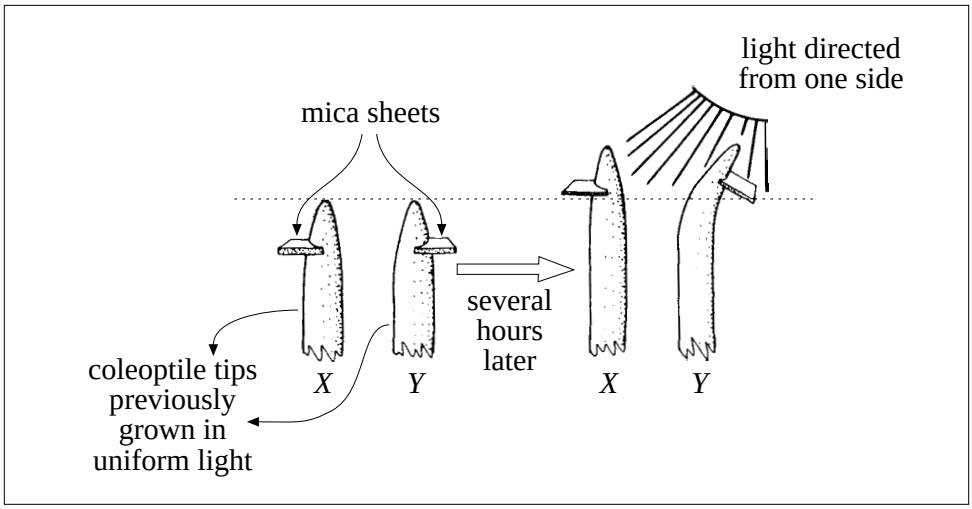
(iii) What name is given to the junction between neurons *P* and *Q*?

(iv) How is the signal in neuron *Q* transmitted to neuron *R*?

Question 34 continues on page 20

QUESTION 34. (Continued) **Marks**

(d) The diagram shows an outline of the experiment of Boysen–Jensen on the growth of coleoptile tips. **3**



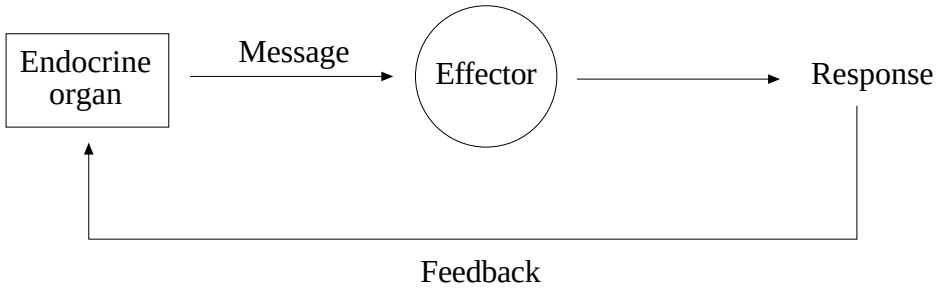
'Biology: the common threads', Aust. Academy of Science 1993.

(i) What type of plant response was this experiment investigating?

(ii) Formulate a hypothesis to explain the difference in the responses of coleoptiles *X* and *Y*.

(e) Name ONE plant hormone you have studied and explain its role in plants. **2**

(f) Many examples of feedback systems occur in the mammalian endocrine system. The diagram below shows a schematic diagram of a feedback system. **5**



(i) Describe a specific example of such a system. State the anatomical structures/chemicals/actions that correspond to Endocrine organ, Message, Effector, and Response in the diagram.

(ii) In your example for part (f) (i) above, what is the effect on the endocrine organ of the effector response? Is this effect positive or negative?

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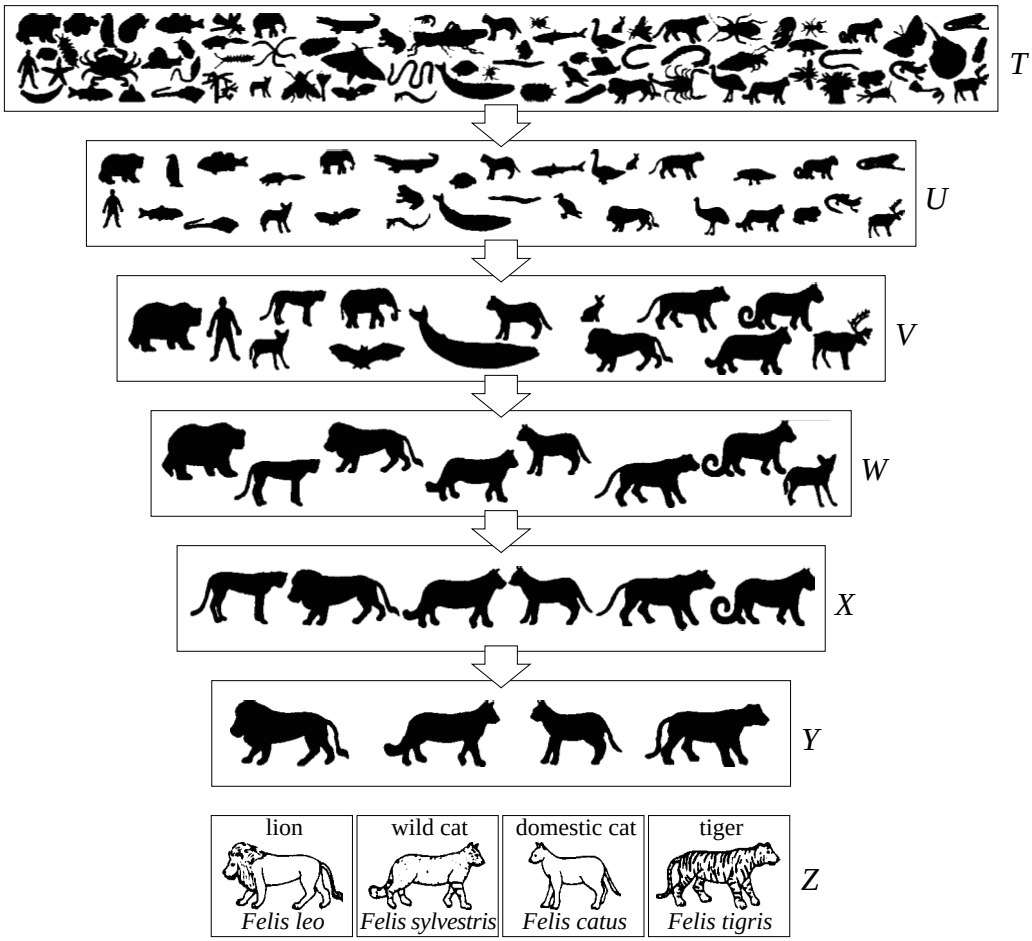
QUESTION 35. Classification and the Species Concept **Marks**

(a) The classification of four types of cats is represented by the following diagram. **6**



'Senior biology', King and Sullivan, Longman 1991, p 246.

(i) Name the categories labelled *T, U, V, W, X, Y, Z.*

(ii) At which level are the organisms most similar?

(iii) Name the genus of the lion.

(iv) List TWO advantages of classification schemes.

QUESTION 35. (Continued) **Marks**

(b) Snow gums are distributed on the slopes of the Brindabella Ranges in an almost continuous belt from 1200 m to 1800 m above sea-level. What information is needed to determine if this population forms a cline? **2**

(c) As a biologist you are asked to identify two unknown organisms believed to be insects. **4**

(i) List TWO characteristics that would confirm their classification as insects.

(ii) Describe THREE features that could be used to classify these insects at the order level.

(d) Waratahs grow naturally among the ridges and plateaus of the Sydney basin, the Blue Mountains, and the Central Coast areas. A related but isolated population grows in the Gibraltar Ranges in north-eastern New South Wales. **2**

Explain how a biologist would determine whether these two populations form a single species.

(e) Name ONE plant family you have studied. **4**

(i) Describe TWO factors that distinguish this family of plants.

(ii) Give the scientific names of TWO species of plants that belong to the family you have named.

(iii) Describe the characteristic(s) that could be used to distinguish between the species of plants you have named.

(f) (i) Name THREE mechanisms that maintain genetic isolation between populations of a single species. **4**

(ii) Explain how genetic isolation contributes to the process of speciation.

(g) The vast majority of blowflies (*Lucilia cuprina*) have red eyes, but other eye colours such as yellow and green are known to occur. These are extremely rare since the common red-eyed flies are better adapted to the natural environment. **3**

(i) How does a variety of eye colours arise in the wild blowfly population?

(ii) What role do variations, such as those for eye colour, play in the process of speciation?

QUESTION 36. The Human Species **Marks**

(a) What evidence would you use to convince another person that human beings are: **2**

(i) animals?

(ii) mammals?

(b) Many people have a problem perceiving *Homo sapiens* as a species of primate, because they see large differences between *Homo sapiens* and other living primates. **6**

(i) Name ONE living primate species that is related to *Homo sapiens* and name ONE structural feature it shares with *Homo sapiens*.

(ii) List FOUR major differences between *Homo sapiens* and other living primates.

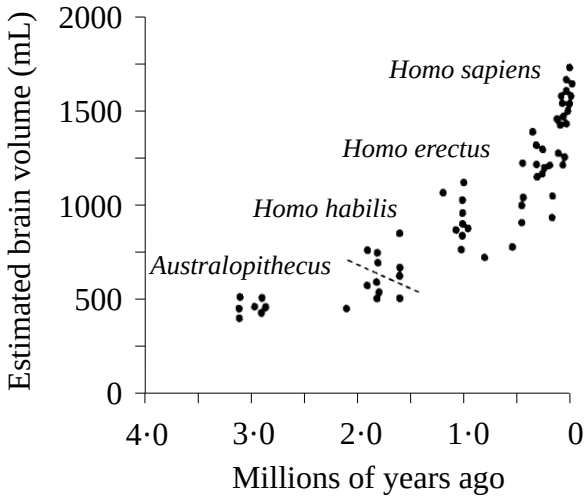
(iii) Taking into account that some species of primate are now extinct, suggest a reason why there are large differences between *Homo sapiens* and other living primate species.

(c) In 1974, an almost complete skeleton of Lucy, a young female *Australopithecus afarensis*, was found in east Africa. Lucy was important in understanding human evolution, largely because of her knee structure, which was typical of upright stance. Her estimated brain volume was typical of other Australopithecines. **4**

RECONSTRUCTION OF SKELETON OF 'LUCY' (*Australopithecus afarensis*)

Due to copyright limitations, this image could not be reproduced here. Please see hard copy of examination paper.

CHANGES IN ESTIMATED BRAIN SIZE DURING THE LAST 3 MILLION YEARS



'Encyclopaedia of human evolution', Jones and Martin, CUP 1992, p 117.

(i) From the evidence, decide whether increased brain size or upright stance evolved first. Explain your answer.

(ii) Suggest TWO advantages of upright stance.

QUESTION 36. (Continued) **Marks**

(d) List TWO differences between biological evolution and cultural development. **2**

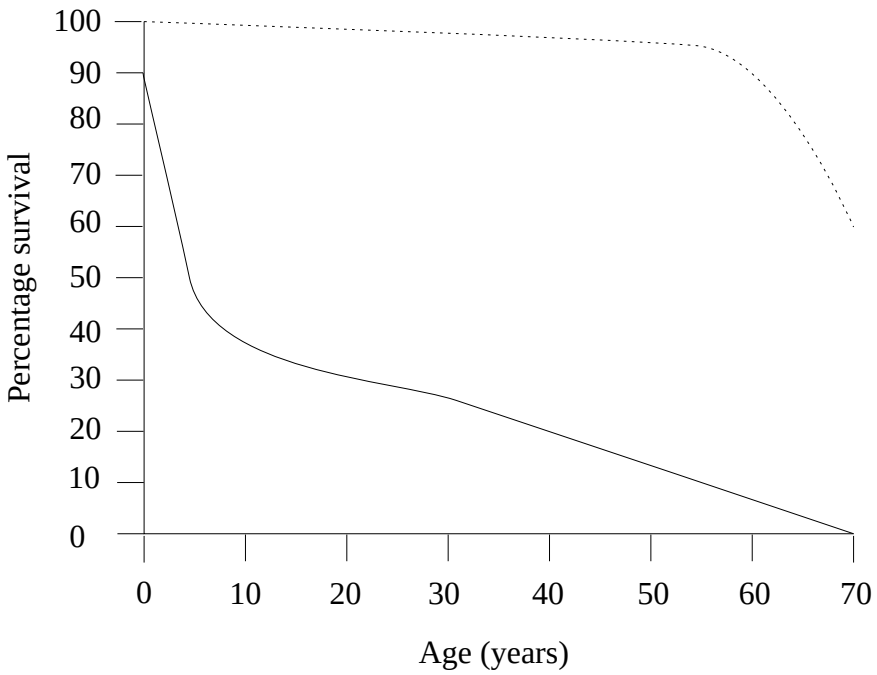
(e) Describe how birth-control techniques might give humans the potential to influence their own evolution. **3**

(f) *Homo sapiens* is described as a polymorphic species. **4**

(i) What is meant by the term 'polymorphic'?

(ii) Name a polymorphic characteristic in humans and briefly describe the adaptive advantage(s) of this polymorphism.

(g) The figure below represents the survival patterns for a hunter–gatherer population and a modern post-industrial population. **4**



(i) Name TWO factors that may be responsible for the difference in survival patterns between the two populations.

(ii) Describe how each factor contributes to the difference in survival patterns.

QUESTION 37. Genes in Action **Marks**

(a) This diagram shows part of the amino acid sequence of a peptide. **4**

—Met—Glu—Arg—Ala—

(i) Using the table of m-RNA codons below, draw ONE possible base sequence in the corresponding m-RNA that codes for this peptide.

(ii) Draw the sequence of bases in the DNA molecule coding for this peptide.

TABLE SHOWING THE GENETIC CODE (m-RNA CODONS)

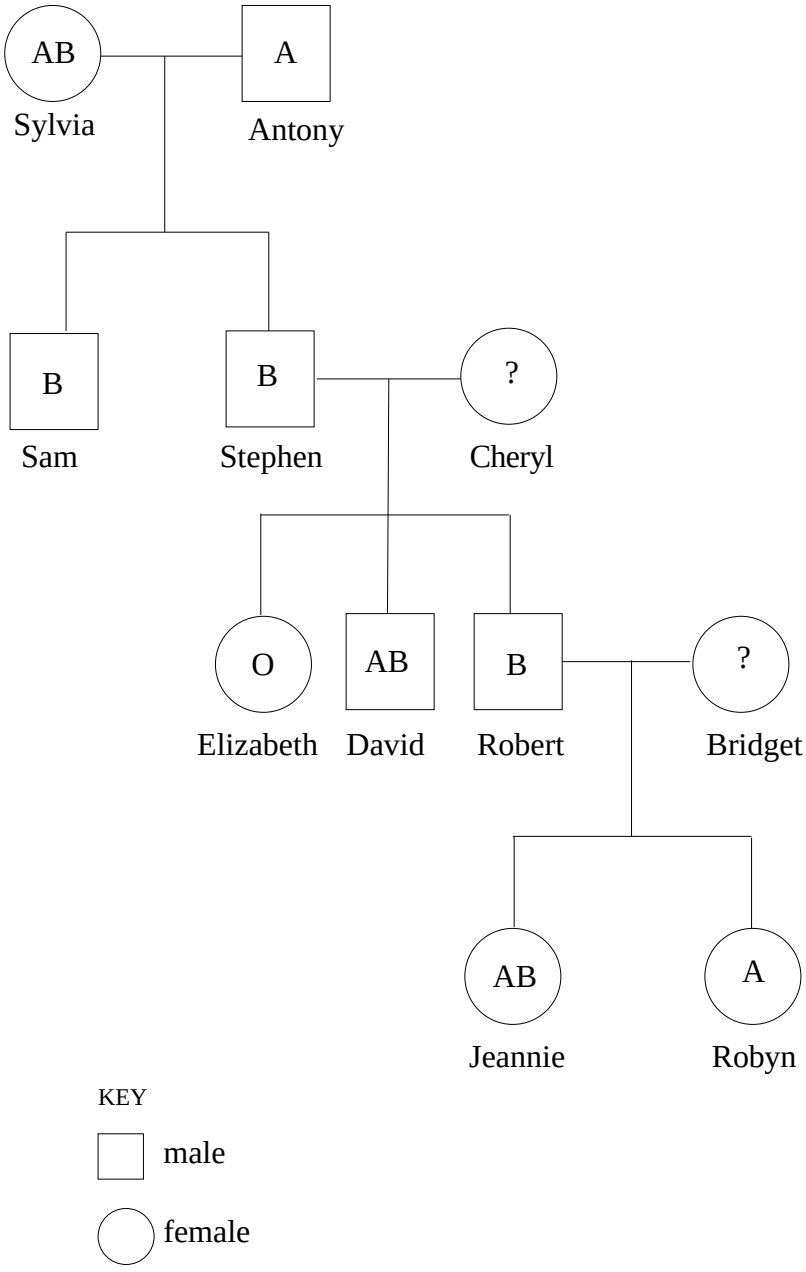
UUU, UUC: Phe UUA, UUG: Leu	UCU, UCC, UCA, CUG: Ser	UAU, UAC: Tyr UAA: Stop UAG: Stop	UGU, UGC: Tyr UGA: Stop UGG: Try
CUU, CUC, CUA, CUG: Leu	CCU, CCC, CCA, CCG: Pro	CAU, CAC: His CAA, CAG: Gln	CGU, CGC, CGA, CGG: Arg
AUU, AUC, AUA: Ileu AUG: Met	ACU, ACC, ACA, ACG: Thr	AAU, AAC: Asn AAA, AAG: Lys	AGU, AGC: Ser AGA, AGG: Arg
GUU, GUC, GUA, GUG: Val	GCU, GCC, GCA, GCG: Ala	GAU, GAC: Asp GAA, GAG: Glu	GGU, GGC, GGA, GGG: Gly

Abbreviated names of amino acids are as follows:

Ala	alanine	Leu	leucine
Arg	arginine	Lys	lysine
Asn	asparagine	Met	methionine
Asp	aspartic acid	Phe	phenylalanine
Cys	cysteine	Pro	proline
Gln	glutamine	Ser	serine
Glu	glutamic acid	Thr	threonine
Gly	glycine	Try	tryptophan
His	histidine	Tyr	tyrosine
Ileu	isoleucine	Val	valine

QUESTION 37. (Continued) **Marks**

(b) The diagram below shows four generations of a family pedigree with the ABO blood-group phenotypes of some family members. Phenotypes that are not known are shown as '?'. **2**



Give a possible genotype for

(i) Antony

(ii) Stephen

(iii) Cheryl

(iv) Bridget.

Question 37 continues on page 28

QUESTION 37. (Continued) **Marks**

(c) In agriculture, the use of artificial selection has resulted in many species of homozygous crop plants. **2**

Discuss TWO problems associated with the cultivation of homozygous crop plants.

(d) This table shows the percentage-recombination rates for four genes, *P*, *Q*, *R*, and *S*, on a single chromosome. **2**

	P	*Q*	*R*	*S*
P	–	30	15	5
Q	30	–	40	25
R	15	40	–	20
S	5	25	20	–

From these data, draw a simple chromosome map showing the relative locations of these four genes.

(e) Use a labelled diagram or series of diagrams to explain how transfer RNA (t-RNA) carries out its function. **3**

(f) (i) What is a ‘plasmid’? **4**

(ii) How are plasmids used to produce important proteins such as insulin?

(g) (i) Explain the difference between polygenic inheritance and multiple allele inheritance. **3**

(ii) Give ONE example of a human polygenic character, and ONE example of a gene with multiple alleles in humans.

(h) A dictionary of biology defines the word ‘mutation’ as: **5**

‘A change in a gene or chromosome that results in variation in the offspring’.

(i) What types of changes are being referred to in this definition?

(ii) What environmental factors may affect the rate at which a gene or chromosome mutates?

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QUESTION 38. Human Environmental Impact **Marks**

(a) (i) Name the introduced species you studied. **4**

(ii) Describe how this species got to Australia, and the methods by which it spread within Australia.

(iii) What effects has this species had on the Australian environment?

(iv) Discuss one method for controlling the spread of this species.

(b) The timber industry in Australia is based partly on native forests and partly on plantations of exotic species (mostly pines). Timber harvesting in native forests usually involves selective logging where some of the trees are felled and removed, leaving others to continue growing. In pine plantations, mature trees are often clear-felled: all trees are removed, and seedlings are planted in their place. **3**

(i) When logging in a native forest, the largest and healthiest trees are selectively removed. Suggest an effect that this practice could have on the gene pool of the tree species.

(ii) Suggest a reason why clear-felling of native forests is no longer carried out.

(iii) Is timber a renewable resource? Discuss.

(c) (i) What is ‘sustainable agriculture’? **4**

(ii) Give an example of an agricultural activity that is NOT sustainable.

(iii) Explain why your example in part (ii) is not sustainable.

(iv) Describe how the preservation of natural habitats could contribute to sustainable agriculture.

QUESTION 38. (Continued) **Marks**

(d) DDT is a pesticide that was in widespread use for insect control in the 1950s and 1960s. It has now been phased out in Australia and replaced by other chemicals. Recently a group of scientists studied the concentrations of DDT in the environment and in the tissues of living organisms. The following table gives some typical figures. **5**

Sample	*Concentration of DDT (parts per million)*
sea water	0·02
plankton	0·13
small fish	1·29
seagull	69·00
human (Australia)	6·10

(i) DDT was sprayed on crops such as wheat and corn to control insect pests. How did DDT get into sea water?

(ii) Use of DDT ceased in Australia in the 1960s. The levels in human tissues in the table were obtained in 1990. Suggest a reason why DDT is still found in human tissues.

(iii) Even if DDT had not been banned because of its environmental effects, it would eventually have been necessary to replace DDT with some other pesticide. Why?

(e) (i) List THREE pollutants that are produced as a result of industrial activity. **6**

(ii) For each of the pollutants listed in part (i), describe how it is produced and its effects on humans and other species.

(iii) For each of the pollutants listed in part (i), describe how it is disposed of at present and suggest ways in which its harmful effects could be reduced.

(f) (i) Draw a graph to show the trend in human population size over the last 300 years. **3**

(ii) Suggest ONE reason that could account for the trend you have indicated in the graph.

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