BOARD OF STUDIES
NEW SOUTH WALES

1996 HSC

EXAMINATION REPORT

Biology

Including:

- **Marking criteria**
- **Sample responses**
- **Examiners' comments**

Published by
Board of Studies NSW
PO Box 460
North Sydney NSW 2059
Australia

ISBN 0 7310 7574 9

96394

1996 HIGHER SCHOOL CERTIFICATE EXAMINATION

BIOLOGY

ENHANCED EXAMINATION REPORT

In 1996 a total of 14 034 candidates sat for the HSC Biology examination. This total reflected a similar decline in numbers in this subject that has been evident each year over the previous five years.

General Comments

The general standard of candidate responses was pleasing, but it is still very evident that a large number of candidates were not adequately prepared for the examination. Many had a poor understanding of the course content and had obviously made little effort to study the course successfully. Hence these students gave general and confused answers that scored few marks.

As in previous years many candidates showed only limited understanding of biological terminology and were confused in the use of the language of biology. Students must understand key words in a question and be able to answer questions that ask them to outline, compare, distinguish or explain, for example. Many candidates simply restated the stimulus material as their answer to the question. Many candidates had difficulty in taking an answer to its logical conclusion. To be successful in this subject it is necessary to understand the content of the course and be able to communicate that information clearly. In many questions it was possible for candidates to use tables when answering, and those who used tables and diagrams in their answer tended to score well.

In the Examination Report samples of some of the marking schemes are provided, as are examples of candidate responses that gained a range of marks available. For each elective a section of the question has the marking scheme reproduced. The purpose is to provide students with the opportunity to read the types of responses that candidates give and see how the available marks are awarded. The mark schemes provided are simplified forms of the schemes used at the HSC. The candidate responses provided are not model answers, but typical answers which may include misspellings, incorrect biology and poor grammatical construction.

Multiple-Choice Questions

The multiple-choice questions were quite straightforward and students generally were able to score well.

SECTION 1: CORE

Part A

The following table gives the percentage of the candidature selecting each option for the multiple-choice questions. The correct answer is marked with an asterisk.

Table 1 — Percentage Candidature

Question	A	B	C	D
1	14·97	1·31	1·75	81·87 *
2	7·91	5·89	11·99	74·00 *
3	54·69 *	8·04	23·96	13·18
4	14·13	72·71 *	7·37	5·72
5	85·88 *	2·75	2·68	8·62
6	16·69	1·28	0·77	81·18 *
7	0·89	4·42	7·61	86·95 *
8	9·38	6·18	76·90 *	7·41
9	6·33	8·04	5·77	79·69 *
10	94·36 *	2·32	2·51	0·75
11	4·82	1·87	87·76 *	5·39
12	1·26	3·04	93·89 *	1·74
13	0·58	12·37	81·85 *	4·97
14	1·58	43·54 *	8·58	46·10
15	47·76 *	32·44	17·91	1·75

Question 16

This question presented no particular problems for the better prepared candidates. Most were able to correctly name oxygen and carbon dioxide as the gases exchanged. Part (b) produced a full range of different processes with many of the candidates correctly selecting diffusion. However, there was a poor understanding of diffusion. Most candidates correctly chose increased surface area for part (c) and were able to list one other structural characteristic. In part (d) most candidates gave an inadequate explanation. Many explained the circulation of the blood bringing oxygen to the cells, and removing carbon dioxide, instead of explaining the maintenance of a diffusion gradient for the exchange of gases.

Question 17

This question was very straightforward. Most candidates were able to list three abiotic characteristics, with only a few candidates confusing abiotic and biotic factors, or not understanding the terms. In part (b), most candidates were able to describe the differences between aquatic and terrestrial environments in terms of the characteristics listed in part (a). Most candidates used direct comparisons while some used comparative terms. Most candidates used the abiotic characteristics listed in the syllabus.

Question 18

Some candidates had difficulty with this question. They read the question as meaning any mechanisms to limit the entry of pathogens into the body, eg washing skin, wearing clothes, blowing nose. Parts (a) and (c) were generally answered better than part (b).

Question 19

This question was generally well answered. Some candidates, however, did confuse the terms ‘structural’ and ‘physiological’ and were unable to organise and apply their knowledge to answer the question.

The marking scheme and a range of candidate responses follow.

In this question each section (a), (b) and (c) was awarded 1 mark, comprising of 2 half marks.

(a)	Curve I represents an ectotherm	1/2 mark
	Explanation of choice	1/2 mark
(b)	Correct structural adaptation for an ectotherm	1/2 mark
	Description of how it helps to regulate body temperature	1/2 mark

(c)	Correct physiological adaptation for an endotherm	1/2 mark
	Description of how it helps to regulate body temperature	1/2 mark

Students were not penalised three times for a mistake in part (a). If they named the endotherm as representing Curve I, they were still able to score marks in parts (b) and (c). A maximum of a 1/2 mark was awarded if a good structural adaptation and description was given for an endotherm. Likewise in part (c), a 1/2 mark was awarded if a good physiological adaptation and description was given for an ectotherm.

Emphasis was placed on the candidates knowing the difference between a structural, physiological and behavioural adaptation.

An example of a response scoring 3 marks:

(a) Ectotherms — because as the air temperature increases so does the body temperature, therefore body temperature is regulated by air temperature.

(b) Some ectotherms have pale coloured scales on their backs to reflect excess heat and therefore regulate body temperature.

(c) Endotherms sweat which releases moisture from their bodies and heat as the moisture is evaporated. This helps to prevent overheating and therefore regulate body temperature.

In each of the above responses, the second part of the answer sufficiently explained or described the name or adaptation.

An example of a response scoring 2 marks:

(a) Ectotherms — because they have a varying temperature depending on the environment, their body temperature increases as air temperature increases.

(b) Ectotherms have the ability to flatten slightly to increase surface area on a cold day.

(c) Endotherms shiver on cold days to produce more heat by increasing their metabolic rates.

Sections (a) and (c) scored full marks but section (b) received zero. It described a behavioural adaptation.

An example of a response scoring 1 mark:

(a) Curve I is the ectotherm's because as air temperature increases so does the body temperature.

(b) Structural adaptations used by ectotherms are scaled skin that can be moved to regulate their body temperature.

(c) Physiological adaptation used by endotherms is a special place where they store water for when it is needed eg a camel.

Section (a) scored full marks. Section (b) named a reptilian feature rather than an ectotherm adaptation, and it then described a behaviour. Section (c) described a structure without naming the adaptation or how it is used.

Question 20

This question was generally well answered.

The principal problem encountered was the lack of understanding of the role of the environment in the transmission of a pathogenic micro-organism. A few candidates had problems distinguishing between macro-organisms and micro-organisms.

Candidates had a good understanding of methods of control. One unacceptable mistake was to confuse 'disease' with agent, pathogen or micro-organism either in the naming of the disease or in describing the route of entry.

Question 21

This question revealed that a large number of candidates had a poor knowledge of experimental method with limited ability to analyse a hypothesis and design an experiment to test it.

Students used some correct terms such as 'control' and 'variation' but did not always use them appropriately in a specific experimental method.

Very few candidates mentioned the need to use large numbers of lizards or the need for repetition.

In marking this question a scheme was drawn up that identified the factors relevant to the design of an experiment.

The marking scheme and a range of candidate responses for Question 21 follow.

Part (a)

Use a control group of infected lizards (ie 2 groups)	1/2 mark
OR	
Use 4 groups of lizards (ie infected at 42°C v infected at 38°C v non-infected at 42°C v non-infected at 38°C)	1 mark
More than one animal used per group	1/2 mark
Temperature as the variant (shade vs sun; 38°C/42°C) NOT light vs dark	1/2 mark
No other variations— ie same: food/size lizard/water/species of lizard/strain of bacteria	1/2 mark
Repetition of procedure or experiment	1/2 mark
Data gathering; eg test lizards/sampling lizards/observe lizards over time.	1/2 mark
MAXIMUM	**2 1/2 marks**

Part (b)

Both groups fight infection at the SAME rate	1/2 mark
OR	
The group at 38°C/in the shade fight the infection faster.	

Candidates' Responses

An example of a response scoring 3 marks:

(a) Get four lizards of the same sex, type, age, weight and health. Infect two of them with the bacteria and place one in the sun and another in a non sunny environment. The other two lizards are controls, put one in the shade and the other in the sun. Watch the lizards and after a while examine them to see how healthy they are.

(b) The infected lizards in the sun would fight the infection no faster than those in the non-sunny environment.

In (a) the candidate scored 1 mark for using 4 groups, two infected lizards and 2 non-infected lizards with one of each in the sun and one of each in the shade.

A 1/2 mark was awarded for no variation, and a 1/2 mark for indicating the temperature as the variant and a 1/2 mark for the implication of data gathering/observing.

Part (b) scored a 1/2 mark for the correct response.

An example of a response scoring 2 marks:

(a) You would need to have two infected lizards —— one which would maintain a body temperature of 38°C and one which would maintain a body temperature of 42°C.

You would then monitor the disease in both lizards.

(b) Both lizards would recover in the same time or the 38°C lizard would recover more quickly.

In part (a) the candidate did not explicitly state a control was needed. The use of two infected lizards scored a 1/2 mark for implying a control group. A 1/2 mark was given for indicating temperature was the variant (38°C v 42°C). Monitoring the disease in both lizards scored a 1/2 mark for data gathering.

In part (b) a 1/2 mark was awarded for the correct response ‘both lizards recover at the same time’ — implying a comparison.

An example of a response scoring 1 mark:

(a) Get four lizards who are identical and apply the infection into them. Then watch and record their movements in a similar environment. After a certain amount of time test the lizards to see how the presence of the disease is.

(b) The disease would still be in the lizard.

The answer to part (a) gained a 1/2 mark for implying no variations between the lizards used; and indicated data needs to be collected — a 1/2 mark.

The response to part (b) did not show a comparison.

Question 22

This question was generally well answered. Many candidates demonstrated a clear understanding of both natural selection and Lamarck’s theory of inheritance of acquired characteristics. Poorly prepared candidates confused the two theories. Many responses displayed a more thorough level of understanding of this topic than has been evident in previous years.

Question 23

This question was generally well answered with many candidates demonstrating a high level of understanding. Poorly prepared candidates tended to list imprecise and general symptoms of disease, rather than specific symptoms of the stated disease. There was some confusion between the cause of a disease compared to a description of the disease, eg 'the cause of obesity is getting fat'.

Question 24

Candidates either displayed a sound understanding of sex linkage or they had little or no knowledge.

In part (a) many candidates simply restated the question. They had a poor understanding of the biological language used in the question.

In part (b) most candidates constructed an accurate punnet square. Some candidates, however, neglected to explain the information contained. Candidates who did not use a punnet square tended to score poorly.

Students scoring low marks showed poor understanding of the use of a punnet square.

The marking scheme and a range of candidates' responses follows:

(a) • One single recessive allele on 'X' is effective in males
- The 'Y' does not have a corresponding allele
- Women need to be homozygous for this effect
- Males 'X' or are 'XY' and females 2 'X's or are 'XX'.

1 mark each to maximum of 2 marks

(b) Yes, can be the same as the father 1/2 mark

	X'	X
X'	X'X'	X'X
Y	X'Y	XY

Constructing a correct punnet square 1 1/2 marks

OR

- Mother is X'X and therefore can give X' or show mother is heterozygous using any symbols 1/2 mark
- Father gives Y 1/2 mark
- Must show result X'Y 1/2 mark

TOTAL **2 marks**

An example of a response scoring 3 marks:

(a) As men only have one X chromosome (women have 2 X chromosomes), if the recessive gene is present on their X chromosome then the characteristic is displayed.

(b)

	X^r	X^n
X^r	X^rX^r	X^rX^n
Y	X^rY	X^nY

^{r} = recessive *father = X^rY*

^{n} = normal *mother = X^rX^n*

Through the use of the punnet square it can be shown that the son can have the same phenotype as the father.

In part (a) the candidate has two of the points required and has used a correct punnet square to explain part (b).

An example of a response scoring 2 marks:

(a) Men are more likely to express the recessive sex linked genes as males either have the disease or they do not. They cannot carry the sex linked disease.

(b) It is possible for the couple to produce a son with the same phenotype as the father as this monohybrid cross illustrates.

	X’	X
X’	X’X’	X’X
Y	X’Y	XY

In part (a) the candidate has gained no marks as they have failed to provide an answer to the question.

In part (b) the punnet square and associated comments have gained the full 2 marks.

An example of a response scoring 1 mark:

(a) Men’s chromosomes are X and Y, so are more likely to have a recessive sex linked gene than women who have XX.

(b) Yes, as the man is recessive and the woman is heterozygous, if they had a son he would have a 1 in 4 chance of being recessive.

In part (a) the candidate has gained a 1/2 mark for stating that males are XY and females XX.

In part (b) the candidate has gained a 1/2 mark for answering Yes — the candidate has not gone on to explain why, therefore no additional marks.

An example of a response scoring 0 marks:

(a) As in the case of red-green colour blindness the female may carry the recessive gene but not show the characteristics as it travels over the X chromosome. Men are highly effected as they will more likely have both recessive genes.

(b) The phenotype of the son would be affected by the outside environment.

In both parts the candidate has failed to include any of the points required to score marks. The response does not answer the question asked.

Question 25

This question was generally well answered and candidates displayed a sound understanding of the topic.

Question 26

Many candidates appeared to write from a broader knowledge of evolution rather than specifically addressing the question.

Many candidates failed to distinguish between a definition and an explanation, attempting to answer both by simply writing one statement.

Some candidates did not include the idea of 'two major groups' in their answer to part (a).

Many candidates were able to answer part (c), although there was some confusion about the nature of the pentadactyl limb, which some incorrectly named as a transitional form.

Few candidates used the 'geographical distribution' line of evidence in part (d).

Question 27

Generally part (a) was not particularly well answered. Many candidates presented multiple sets of letters in part (a)(i) rather than giving the one genotype.

Some candidates gave AABb and aabb as the answer, indicating that they interpreted the question as relating to the parents of the illustrated cell.

Part (b) was well answered, most candidates naming two different mechanisms for introducing genetic variation.

In part (c) some candidates tended to rewrite the question and thus seldom gained full marks. Most candidates understood that natural selection occurs and that those organisms with favourable adaptations survive. Few mentioned changes in the environment or the passing of favourable variations to the next generation.

The marking scheme and a range of candidate responses follow:

Marking Scheme — Question 27

(a) (i)	Genotype of Parent AaBb (or any combination)	 1 mark
(a) (ii)	Genotype of Gametes AB Ab aB ab	3 or 4 correct = 1 mark 1 or 2 correct = 1/2 mark
(b)	Mechanisms for Genetic Variation Two named mechanisms	1/2 + 1/2 mark Maximum = 1 mark
(c)	Evolutionary Advantage of Variety • environmental change • variety increases the chance of survival (survival of the fittest or natural selection) • advantageous or favourable traits or genes passed to the offspring or unfavourable are eliminated • enhanced species survival OR • populations become isolated • in different environments • selection of different variations • resulting in formation of new species or speciation	 1/2 mark 1/2 mark 1/2 mark 1/2 mark 1/2 mark 1/2 mark 1/2 mark 1/2 mark **Maximum = 2 marks**
	TOTAL	**5 marks**

An example of a response scoring 5 marks:

(a) (i) *AaBb*

(ii) *AB, Ab, aB, ab*

(b) *Random fertilisation*
Mutations

(c) *The production of variable offspring ensures the survival of a species in a changing environment. The greater the variation the greater chance that individuals in a population can be suited to the effects of a different habitat, and thus pass on those favourable characteristics to offspring.*

Genotypes of the parent cell and of the daughter cells are given correctly and the two different types of mechanisms to introduce genetic variability are correct.

In part (c) 2 marks were awarded because the answer included four correct statements from the marking scheme.

An example of a response scoring 4 marks:

(a) (i) *AaBb*

(ii) *AaBB & Aabb*

(b) *Independent assortment of chromosomes*
Random segregation of genes in meiosis

(c) *If variation exists in a population, if environmental conditions change (eg weather) the species will be able to survive with those organisms which have characteristics which best suit the environment. These offspring are then able to survive and pass these characteristics onto their offspring.*

This answer gives incorrect genotypes for the daughter cells in part (a)(ii).

All other parts of the answer gained full marks.

An example of a response scoring 3 marks:

(a) (i) *AaBb*

(ii) *AaBb*

(b) *Frameshift mutations*
Cross breeding

(c) *Favourable characteristics are passed on to generations. These assist in their survival. Unfavourable characteristics are lost. Offspring will continue to produce variation and therefore produce new adaptations.*

In this answer, parts (a)(i) and (b) are correct and therefore gained full marks.

In part (a)(ii) the genotypes of the daughter cells are not correct. In part (c) there is no mention of changes in the environment or of survival of the species. One mark was awarded because two points were mentioned from the marking scheme.

An example of a response scoring 2 marks:

(a) *(i)* *AaBb*

(ii) *AaBB, Aabb, AaBb, AabB*

(b) *incomplete dominance*
genetic engineering

(c) *New genetic characteristics are the outcome of crossing over. This allows every single separate species to have different features and some different aspects about them, eg eye and hair colour.*

The parent cell genotype is correct in (a)(i) and two correct mechanisms for genetic variability are given in (b), therefore two marks were awarded.

In part (a)(ii) no marks were awarded because the genotypes of the daughter cells are incorrect.

In part (c) variability is discussed but it has not been linked to its advantage in evolution and therefore no marks were awarded.

An example of a response scoring 1 mark:

(a) *(i)* *AAaa BBbb*

(ii) *Aa Aa Bb Bb AA aa BB*

(b) *(no answer)*

(c) *Advantage of producing offspring that vary from each other is that they have different favourable variations. Some may be well adapted to their environment and able to produce offspring which might have a more favourable variation.*

This answer scored no marks for the genetics section.

In part (a)(ii) seven genotypes are given but, again, none is correct. To gain a full mark, three or four of the genotypes had to be correct.

In part (b) no answer was given.

In part (c) there are two correct points from the marking scheme. There is no mention of changing environment, species survival or speciation.

Question 28

Part (a) This question was generally well answered. Candidates' understanding of Koch's postulates was generally sound. Some candidates did not recognise that the bacteria also need to be isolated from the second host, cultured and identified as the same as the original. There was confusion between 'bacteria' and 'disease' in part (b), eg the 'disease was injected into a healthy ...'

Part (b) A significant number of candidates did not attempt this part of the question.

Some candidates answered this in terms of Koch's postulates—perhaps misinterpreting the question as '... causes of disease'.

A small number of candidates gave answers in terms of a non-human disease.

Many candidates gave detailed answers about the history of a disease rather than the history of the cause of a disease.

Candidates chose a great variety of diseases for their answers. Generally, answers concerning malaria, AIDS and many genetic diseases were better answered with candidates showing good knowledge of the history of the cause of their chosen disease. Students who used 'macroscopic parasite diseases' generally did not have a knowledge of the historical development of the cause of their chosen disease.

Question 29

In part (a) some candidates 'accounted for' these changes, instead of 'describing' them, thus failing to score.

In parts (b) and (c) the secondary immune response was not well understood in terms of antibody levels, although most candidates understood the concept of immunological memory. Most graphs wrongly showed the peak in antibody level due to the second injection being smaller than the first.

Part (d) was well answered. Most candidates knew that antibodies are specific for each antigen and a pleasing number also recognised that in rare cases with closely related bacteria, the answer might not be as certain.

In part (e) most candidates chose to describe phagocytosis, which they knew quite well.

The marking scheme and a range of candidate responses follows.

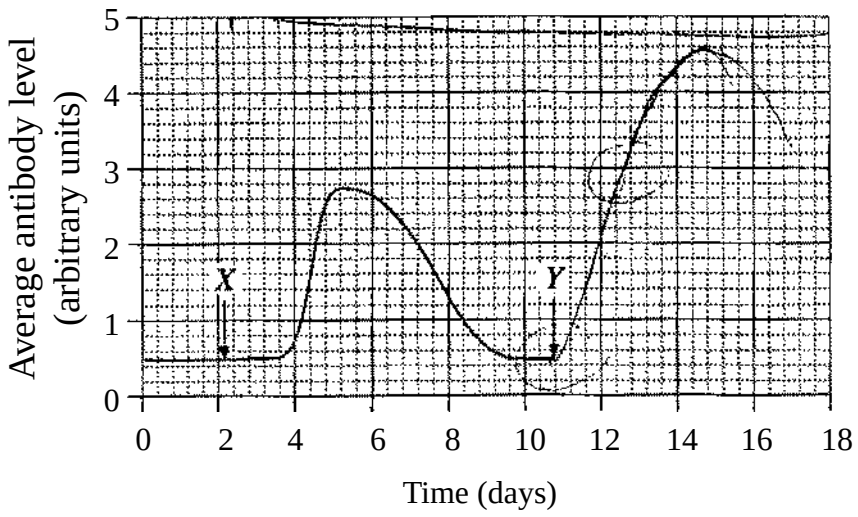
Marking Scheme — Question 29

Part	Response	Marks
(a)	Described –	
	• the delay in starting • the rise to a peak • the fall back to the original level	2 points = 1/2 mark 3 points = 1 mark
(b)	The graph (features it should show) –	
	• the response delay is less • a steeper gradient of the rise is shown • the peak is higher • the fall is slower	1 feature = 1/2 mark 2 features = 1 mark
(c)	2 points –	
	• explained the general change in shape of the graph in terms of immunological memory + 1 point each – • explaining each of the four features of the graph (as in part (b))	2 points = 1/2 mark 3 points = 1 mark
(d)	Either –	
	• no • explanation of antibody specificity OR • yes, provided that they explain that it is only for closely related bacteria	1/2 mark + 1/2 mark OR 1 mark
(e)	Description of –	
	• the cell mediated response OR • Phagocytosis OR the inflammatory response	1 mark

An example of a response scoring 5 marks:

(a) *Antibody level increased after 4 days, 2 days after X was injected. It increased quickly to nearly 3 arbitrary units, peaked at about 5 days, then decreased steadily until 10 days it was where it started.* (1 mark)

(b) (1 mark)



(c) *Antibody production would happen much faster and in greater amounts due to memory cells from the first injection 'recognising' the antigen specifically, and antibodies specific to this antigen produced.* (1 mark)

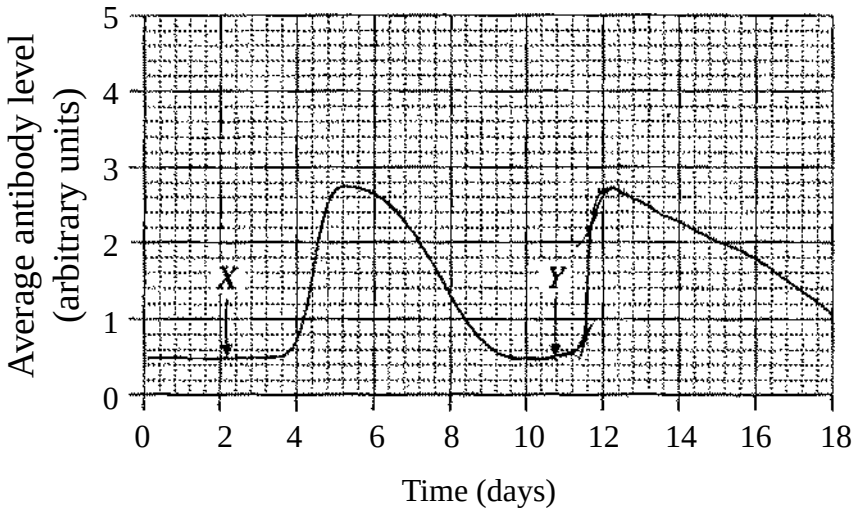
(d) *No, each antigen is different and the antibodies produced at X are only effective against the bacteria they 'locked' into at X. Antibodies are specific to each antigen.* (1 mark)

(e) *Phagocytosis is where phagocytes are able to engulf foreign particles like bacteria.* (1 mark)

An example of a response scoring 4 marks:

(a) *At day 4, antibodies are produced reaching a maximum at day 5, then slowly decreasing.* (1/2 mark)

(b) (1 mark)



(c) *The production of antibodies is much more rapid as the pathogen has been encountered already. B-memory cells store this information.* (1 mark)

(d) *No. Each antibody is produced specifically to combat a certain type of antigen. A new, different antibody would be needed.* (1 mark)

(e) *Production of T-killer cells which destroy pathogens by phagocytosis.* (1/2 mark)

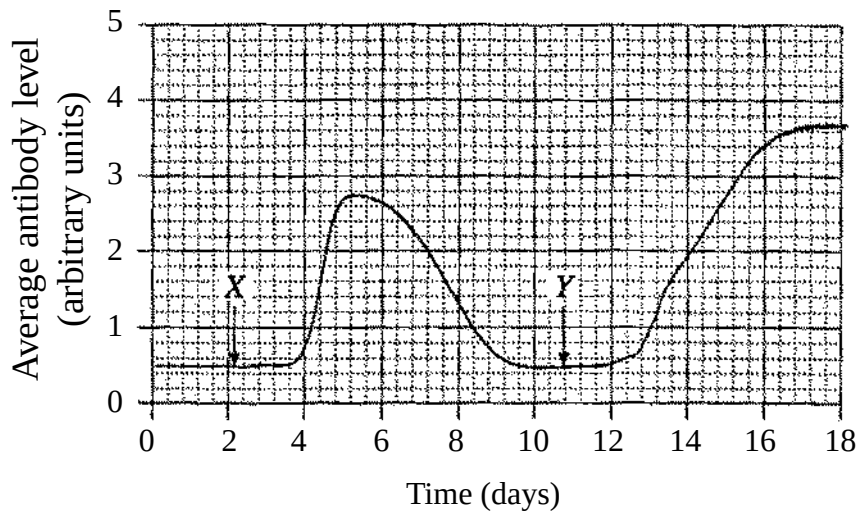
The candidate scored only a 1/2 mark in part (a) because it was not stated that the level returned to its original value.

Part (e) scored only a 1/2 mark because T-killer cells do not carry out phagocytosis.

An example of a response scoring 3 marks:

(a) *The antibody levels increased and 3 days after the level decreased back to the original level.* (1/2 mark)

(b) (1/2 mark)



(c) *The antibody level in the booster injection would be much higher and would be enough to keep antibody levels high as shown on the increase of the second curve.* (0 marks)

(d) *No. The antibodies only attack one strain of bacteria as they only recognise this and then attack it. It wouldn't attack any other bacteria.* (1 mark)

(e) *In phagocytosis, the white blood cells injest and destroy foreign material.* (1 mark)

In part (a) the candidate did not refer to the period of constant antibody level following the injection.

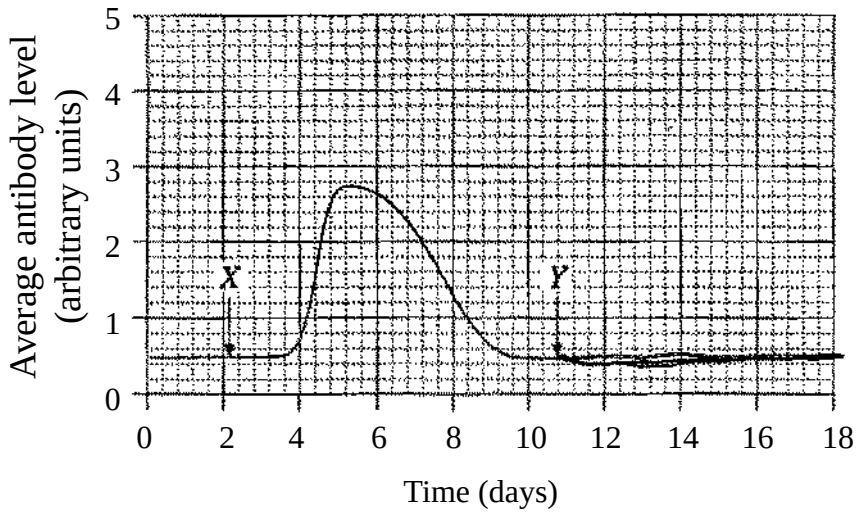
In part (b) the rise in level should occur in a shorter time than shown by the candidate.

In part (c) the candidate has not mentioned immunological memory.

An example of a response scoring 2 marks:

(a) *Two days after injection the antibody levels rose quickly in half a day then slowly returned to normal over the following 3 1/2 days.* (1 mark)

(b) (0 marks)



(c) *The shape of the curve means that the rabbits have been affected by the disease already, thus do not become affected by it again.* (0 marks)

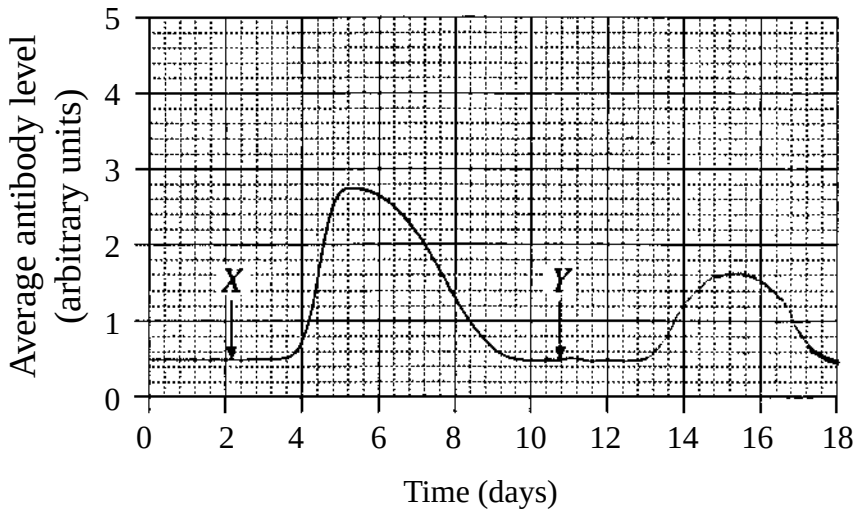
(d) *No. Because the antibodies must be suited to the exact shape of the disease organism in order to stop it.* (1 mark)

(e) *By antibiotics or by being immunised by a doctor.* (0 marks)

An example of a response scoring 1 mark:

(a) *The antibody levels rose for the first 3 days then for the next 4 days dropped back to the original level.* (1/2 mark)

(b) (0 marks)



(c) *The antibody levels would take longer to rise and wouldn't rise so far.* (0 marks)

(d) *No, because the antibodies produced would be immune to that disease.* (1/2 mark)

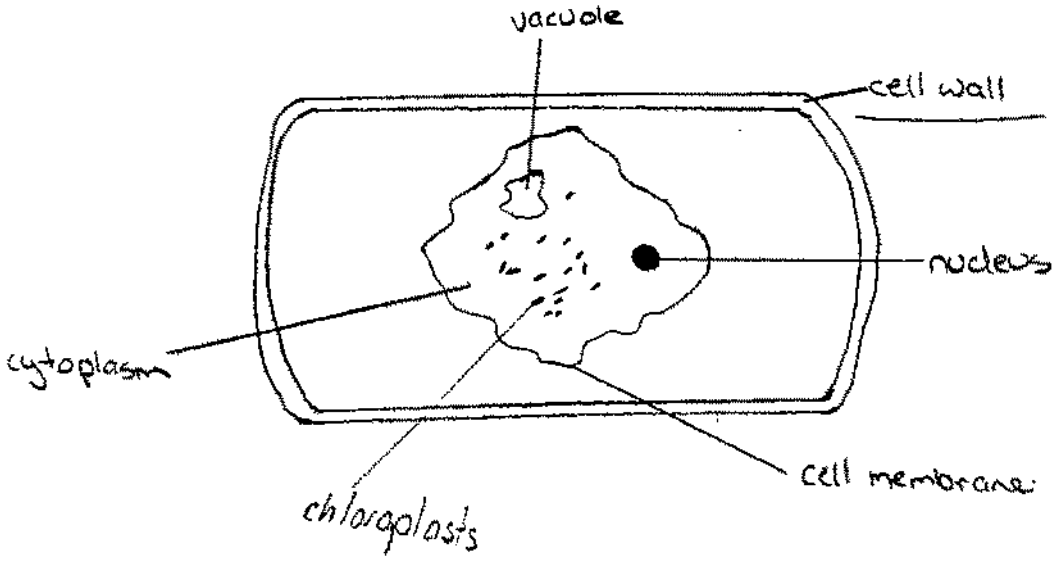
(e) *B-cells and T-cells.* (0 marks)

Question 30

Part (a) Most candidates had a sound understanding of the concept of the 'control' group and its purpose to compare with the experimental group. A number of candidates confused the control group with controlling variables in the experiment.

Part (b) Many candidates knew the processes involved but failed to directly answer the question asked. Statements tended to be general, rather than specific to the question, eg 'plants were not watered, so they wilted' rather than 'plant cells lost water and therefore lost their turgidity'.

Part (c) The quality of diagrams was generally poor. Candidates either knew what a plant cell looked like or had little idea. Candidates should remember to carefully label all diagrams and include components relevant to the question. Many candidates failed to include chloroplasts in their diagram. A sample diagram awarded full marks is reproduced on the opposite page.



Part (d) Generally, candidates had a good knowledge of relevant adaptations. However, many descriptions of adaptations were not specific enough, eg:

1) 'small surface area to reduce water loss'

OR

2) 'desert plants store water'

rather than:

1) 'leaves have a small surface area to reduce water loss'

OR

2)'desert plants have succulent leaves to store water'.

Question 31

The majority of candidates were able to identify the recessive characteristics but were not able to explain their reasoning very well. Most candidates were able to successfully use symbols for the working of the genetics, but, some had difficulty with gamete formation and structuring of a dihybrid cross. Many candidates need to take more time to logically and thoroughly present the working for their solutions.

Question 32 — The Australian Environment

In this type of question, candidates need to be guided by the allocated marks in each section when writing their responses. For example, many candidates wrote very long answers to part (a), when compared to the responses to part (e), but both parts were worth the same marks.

Knowledge of Continental Drift was good, but distribution of organisms was less well understood. Many responses concentrated on isolation of marsupials.

Knowledge of introduced species was also good. Candidates had problems relating either a physical or chemical compound to the distribution of a species. Answers tended to be general. Most candidates interpreted the data maps quite well, and showed ability at predicting and estimating from the data (in parts (d) and (e).

Many candidates had problems with the distribution patterns in part (e).

The marking scheme and a range of candidate responses for Question 32 part (b) follow.

(b)	(i)	Name of introduced species.	0 marks
(b)	(ii)	Effect of this species on the environment 1.	1/2 mark
		Explanation of the effect of this species on the environment 1.	1/2 mark
		Effect of this species on the environment 2.	1/2 mark
		Explanation of the effect of this species on the environment 2.	1/2 mark
(b)	(iii)	An explanation of WHY it has become a pest.	1 mark

An example of a response scoring 3 marks:

(b) (i) European Rabbit

(ii) Due to a high reproductive rate and adaptability to the Australian environment, the rabbit has reduced the abundance and eventually distribution of Australian natural fauna by outcompeting natural heriborves which reduce in number which in turn reduces numbers of predators who rely on these animals for food source.

Causes soil erosion by uprooting bushes and shrubs which act to hold topsoil down and through burrowing into the soil.

(iii) In other parts of the world may have similar climate and environmental conditions to that of Australia thus eucalypts may be well adapted to survive there. With the absence of natural predators they are able to thrive and grow unchecked.

This candidate gained full marks in part (ii) because there were two effects

- reduced abundance of native fauna and
- outcompeting natural herbivores and causing soil erosion.

The candidate gained the part (iii) mark by stating ‘absence of natural predators’.

An example of a response scoring 2 marks:

(b) (i) *Cane Toad*

(ii) *Has destroyed the natural habitat of indigenous species, the large numbers have created competition for natives within breeding grounds such as creeks and other freshwater outlets. Have also created competition for food sources with natives.*

(iii) *Within an ecosystem to which they are not native, eucalypts may provide competition for soil nutrients, water, location etc. for other plants. The distribution and abundance may also become uncontrollable because there is no natural consumers or predators in the foreign ecosystem.*

This candidate gave one effect (1/2 mark) and one explanation (1/2 mark) ‘destroyed habitat of ... natives’ by ‘competition for breeding ground’. The candidate did not describe a second good effect or explanation. The candidate gained the mark in part (b)(iii) by stating ‘no natural consumers or predators’.

An example of a response scoring 1 mark:

(b) (i) *Rabbit (1788)*

(ii) *The wild pig ruined the land and caused extinction of native animals. Basically it destroys the environment in which it lives.*

(iii) *They have become a pest because they are able to adapt to many different environments. If they adapt then they will thrive in that environment.*

In part (ii) the candidate gave two effects, but no explanations of the effects.

In part (iii) the candidate did not give a specific reason for eucalypts becoming a pest.

The marking scheme and a range of candidate responses for Question 32 part (d) follow.

(d)	(i)	Climate difference 1: temperature	1/2 mark
		Climate difference 2: rainfall	1/2 mark
	(ii)	Adaptation factor	1/2 mark
		Food web factor	1/2 mark
	(iii)	Human activity: abiotic change	1/2 mark
		Human activity: biotic change	1/2 mark
	(iv)	Foot adaptation: heat, water or surface area	1/2 mark
		Hair adaptation: heat, water or surface area	1/2 mark
	(v)	Capture with recapture	1/2 mark
		Explanation: movement	1/2 mark

An example of a response scoring 5 marks:

(d) (i) *The climate of the Sminthopsis lencopus would be a lot cooler and experience more regular rainfall than that of the Sminthopsis virginiae (whose habitat would also be a lot more arid).*

(ii) *It may have many more adaptations which allow it to live in more areas. For example, it may be able to eat more and varied types of food.*

The Sminthopsis crassicandata may also not face as much predation due to differences, eg its ability to run away, or unpalatability to predators.

(iii) *Human invasion of its habitat, the felling of trees and forests for grazing and urban land has destroyed its habitat.*

Introduced species such as the fox and cat may have preyed on the animal and reduced its number.

(iv) *These long feet with hair would make movement in the unstable sand a lot easier as the hairs between the toes would act as a type of 'webbing' (like aquatic birds have).*

To make movement in sandy environment easier.

(v) *The capture/recapture method would be best, ie;*

Number tagged originally

Number tagged in sample x No in sample as other methods such as quadrats would not be successful as the dunnart is quick moving and may escape before it is accounted for in the quadrat.

An example of a response scoring 3 marks:

(d) (i) *One is in a colder low rain area which has more swamps and rivers (leucopus), the other lives in a more dry and cold area.*

(ii) *Their fat tail might be a food supply so it can last longer between meals. It also might be better adapted to change in environment.*

(iii) *Because of development in the area also the introduction of more domestic cats and dogs.*

(iv) *So its feet don't sink in the sand therefore making it faster on the sand which will help it escape predators.*

(v) *Trapping over wide areas all over Australia to see what type of dunnart are there. Once caught they could be tagged electronically so they can be found using other electronic machines, eg transmitters. This would be good because you will always now where they are.*

In part (ii) the candidate refers to environment in general, rather than a specific component, so the answer loses a 1/2 mark.

In part (iv) the candidate omits any reference to the hairs, so cannot score full marks (1/2 mark).

In part (v) the candidate refers to tagging, but not to 'recapture', which would be necessary to determine abundance. The answer does not refer to the mobility of dunnarts, so it does not score any marks.

An example of a response scoring 1 1/2 marks:

(d) (i) *The Sminthopsis virginiae live in the top of Australia and in hotter conditions.*

The Sminthopsis leucopus live in the colder conditions having a thicker fur would be likely.

(ii) *1. Smithopsis crassicaudata may be able to adapt better to the conditions and climate.*

2. The Sminthopsis may be a better survivor.

(iii) *It is a less better fighter than it used to be.*

It may not have to be very large where it has moved to.

(iv) *Long broad feet may help them get away from predators quickly and the fringe of hairs may be a way of keeping themselves cool.*

(v) *Quadrat or recapture, because there is too many dunnarts to do it any other way.*

In part (ii) only temperature is compared (1/2 mark). Another climatic factor was necessary to score full marks.

In part (ii) the environmental conditions discussed are too general.

In part (iii) the changes are Lamarckian in concept and outside the marking scheme.

In part (iv) both 1/2 marks available were awarded.

In part (v) only 'recapture' is mentioned, without any other link. The explanation given lacks the detail necessary to score marks.

Question 33 — Structure and Function of Cells and Tissues

The question was generally well answered by most candidates and the standard of biochemistry was sound. Part (a) was generally well answered and despite the different presentation of the light and dark phases of photosynthesis, many candidates correctly identified the unknowns in the diagram. Many candidates, however, did not understand the term 'outline the pathway' and merely named glycolysis in part (b). The majority of candidates now know how to draw and label a mitochondrion but it is emphasised that an outer membrane and a single inner-folded membrane must be drawn.

In part (d) the root tip cross-sections were generally poorly drawn with candidates drawing sections in any region of the root rather than the root tip. Generally, comparisons were poor between immature and mature cells and candidates had difficulty indicating this with labels on a diagram.

In part (e) the concept of enzyme/substrate specificity was well answered but most candidates had difficulty in applying this knowledge to the antibacterial drug example.

In part (f) the structure/function relationship of named animal tissues was generally well done. Those candidates who chose nerve tissue had more success in answering the question.

The marking scheme and a range of candidate responses for Question 33 part (d) follow.

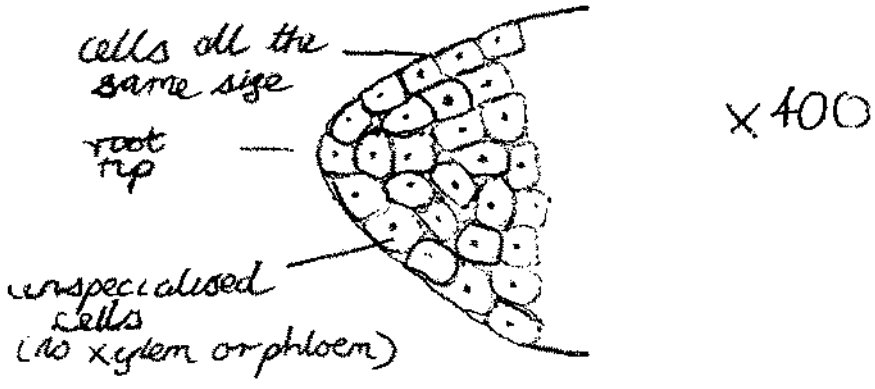
(d)	(i)	Root tip	1 mark
	(ii)	Root cap function (to protect root tip)	
		well explained	1 mark
		poorly explained	1/2 mark
	(iii)	Diagram of root tip or elongation zone TS or LS	
		good	1 mark
		poor	1/2 mark
		1st good distinguishing feature	1 mark
		poor	1/2 mark
		2nd good distinguishing feature	1 mark
		poor	1/2 mark
		TOTAL	**5 marks**

An example of a response scoring 5 marks:

(a) *(i)* *Root tip*

(ii) *To protect the root tip. The root cap is constantly being worn away and is replaced by new cells all the time.*

(iii) *Root tip under the light microscope.*



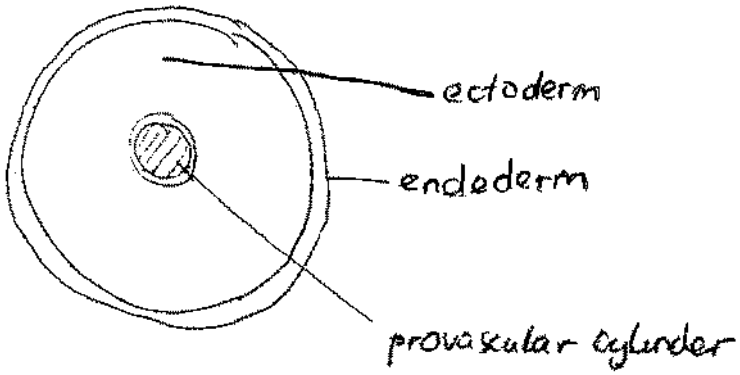
The answer scored 1 mark in part (i) for the correct location of cell division. A correct function of the root cap was also given. The diagram was a good cross-section of the root section and scored 1 mark. The features that distinguished it from the maturation zone — ‘cells all the same size’ and ‘lack of specialised cells (xylem and phloem)’ — were both correct and scored 1 mark each.

An example of a response scoring 4 marks:

(d) (i) *In the root tip.*

(ii) *Protects the root tip.*

(iii) *ROOT TIP (under light microscope).*



In the root tip there are many undeveloped features not yet present

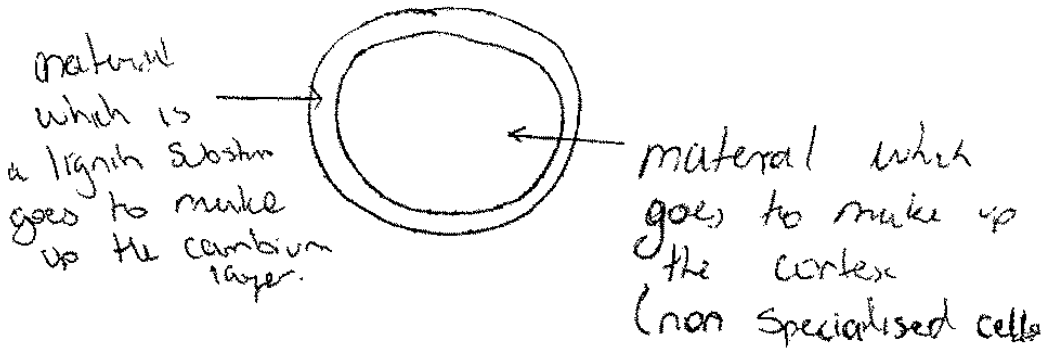
This answer scored 1 mark each in parts (i) and (ii) for correct answers. The diagram was correct in that the TS of the root tip clearly showed the different cell or tissue regions and correctly labelled at least one of them. The one feature not present in the maturation zone correctly labelled was the provascular cylinder. Ectoderm and endoderm were incorrect labels.

An example of a response scoring 2 1/2 marks:

(d) (i) *In the zone of MATURATION.*

(ii) *A hard protective coating used to burrow through soil.*

(iii) *Cross-section of a root tip.*



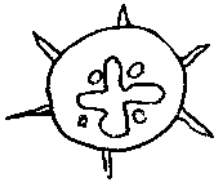
This response scored zero for the incorrect zone of maturation and 1 mark in part (ii) for a correct function of the root cap. The diagram was poor and scored a 1/2 mark as it did not clearly indicate the correct tissue regions in the root tip cross-section. The only feature labelled correctly is the 'non-specialised cells', which scored 1 mark.

An example of a response scoring 1 mark:

(d) (i) *Most cell divisions would occur in the maturation zone.*

(ii) *The function of the root cap is to push through the soil and protect the root tip.*

(iii)



This candidate scored zero in part (i) but scored 1 mark in part (ii) for the correct function of the root cap. The drawing in part (iii) was of the zone of maturation and hence scored no marks. There were no features labelled.

Question 34 — Control and Coordination

Candidates seemed well prepared for this question and the standard of answers was improved this year with all parts well answered by many candidates, with the exception of part (c). Many candidates scoring well in other sections did very poorly in answering the question on neurons. To answer this question required interpretation of the diagram and an understanding that sodium ions moved first. To answer this elective well, candidates must answer the question asked. For example, when asked for the name of a specialised cell in part (d)(i), they must name the cell, not the tissue, eg rod cell, not retina. When asked to explain in part (g)(i) candidates must not describe the process but explain why it occurs.

The marking scheme and a range of candidate responses for Question 34 part (c) follow.

(c) (i) Towards X — 1 mark

(ii) Na^+/K^+ pump, ADP...ATP, Respiration, Repolarisation, active transport — 1 mark

Any mention of diffusion or passive transport did not score.

(iii) More neurons respond or more rapid firing of neurons — 1 mark

Greater energy of impulses, different neurotransmitters did not score.

An example of a response scoring 3 marks:

(c) (i) The impulse is moving towards X.

(ii) Once the wave of dipolarisation finishes the membrane is not permeable to the sodium potassium pump, therefore ceases movement.

(iii) The difference between differing strength impulses is the quantity of impulses performed. If there are a lot of impulses, the larger the strength.

The answer to part (ii) is correct.

In part (iii) mention of the active nature of the process such as the Na^+/K^+ pump scored 1 mark.

In part (iii) the number of impulses scored 1 mark.

An example of a response scoring 1 mark:

(i) Travelling towards Y from X.

(ii) After the impulse has passed there is a moment of depolarisation. The process which maintains resting potential is ionic charges. The cell becomes permeable to potassium which allows it to regain the negative charge inside. Ready for another impulse.

(iii) They are distinguished by the number of impulses per second. The greater the strength the greater the number of impulses. It is the inhibitor and exhilay which prevent messengers from passing. If an impulse is not strong enough, eg when you sit on a chair for a long time, then the inhibitor will prevent this impulse from being passed.

The answer to part (i) is incorrect.

In part (ii) the candidate mentioned only the passive process and does not score.

The answer to part (iii) scores 1 mark for the statement of the number of impulses per second.

An example of a response scoring 0 marks:

(i) Moves towards Y from X.

(ii) After the sodium ions have diffused an imbalance occurs between the ions. The potassium ions therefore diffuse out of the neuron to keep an equal amount of ions on the inside and out.

(iii) Different strengths can be distinguished by the permability of the neuron. The higher the strength the more neurotransmitter is released therefore the nerve permeability becomes higher. This allows more ions to pass through causing a bigger imbalance therefore different strengths are distinguished by the permeability of the neuron membrane.

Part (i) is incorrect.

The response to part (ii) does not mention the Na^+/K^+ pump or active transport.

The response to part (iii) does not mention the number of neurons or frequency of impulses per second.

The marking scheme and a range of candidate responses for Question 34 part (g) follow.

(g)	(i)	Block 1 contains auxin/block 2 does not score	1 mark
		Statement that auxins move from agar block 2 to 1 does not score.	
	(ii)	Cells elongate	1/2 mark
		Cells expand or grow more quickly does not score.	
	(iii)	Phototropism	1/2 mark
		Bending towards the light does not score.	
	(iv)	Maximum sunlight, efficient photosynthesis	1 mark
		To grow towards light does not score.	

An example of a response scoring 3 marks:

(g) (i) Coleoptile X bends more because agar block one had more auxin in it. Block one of agar had more auxin because it was the block under the part of the tip away from the sunlight. Auxin is more abundant in cells away from the sun. When placed on test coleoptiles block one with more auxin causes X to bend more than Y because block two of agar had less auxin.

(ii) *The cells are elongated by the presence of auxin.*

(iii) *Phototropism.*

(iv) *Phototropism allows plants to make more sunlight available to them. This is beneficial for plants because they require sunlight to photosynthesise.*

The candidate scored 1 mark in (i) for correctly explaining that there is more auxin in the agar block under the part of the tip away from the sunlight.

In part (ii) the candidate scored a 1/2 mark for stating that the cells are elongated.

In part (iv) the candidate scored 1 mark for linking the response of sunlight available to photosynthesis.

An example of a response scoring 2 marks:

(g) *(i)* *It is because of phototropism. The light is close to Y but X has to bend over to reach the light and therefore grows that way.*

(ii) *The cells are elongated to allow the plant to bend towards the light.*

(iii) *Phototropism is being investigated in this experiment.*

(iv) *This allows growing plants to change direction to gain the most amount of light needed for photosynthesis and food production.*

In part (i) the candidate scored zero. The test coleoptile X bends because of the presence of auxin in the agar block not because of the light.

In part (ii) the candidate scored a 1/2 mark for stating that the cells elongate.

In part (iii) the candidate scored a 1/2 mark for the correct response.

In part (iv) the candidate scored 1 mark for stating that growing plants gain the most amount of light from photosynthesis.

An example of a response scoring 1 mark:

(g) *(i)* *The light source is directed from one side. Coleoptile Y is closer to light source than coleoptile X.*

Coleoptile X bends more than coleoptile Y because Y is more exposed to the sun than X and cell growth will be greater in X, as X requires the same amount of light as Y.

(ii) *The cells in the stem of coleoptile X bend towards the light because of sunlight stimulating auxins, to promote all elongation.*

The cells at point A were not directly exposed to light, and elongated and bent towards the light to ensure that it would be exposed to light.

(iii) Phototropism.

(iv) They do not need light to begin.

In part (i) the candidate scored zero marks. Coleoptile tip X does not bend because it is further from the light source.

In part (ii) the candidate scored a 1/2 mark for correctly answering that auxins promote cell elongation.

In part (iv) the candidate scored zero marks. The statement does not describe an advantage of the observed response in growing plants.

QUESTION 35 — Classification and the Species Concept

A number of candidates were poorly prepared to answer the questions set. Both parts (a) and (f) involved an understanding of clines and the process of speciation. Many candidates seemed unfamiliar with the most commonly proposed means for the formation of new species, whereby genetic variation is acted on by natural selection after groups of a single species have become physically (geographically) separated from each other. Because of this no interbreeding occurs. As there is no gene flow between the groups there is no dilution of any genetic changes produced by different natural selection pressures acting on each group. The groups may become reproductively isolated from each other due to these changes. A cline has the potential to result in the formation of more than one species. Variations within the cline can readily lead to speciation if parts of the cline are geographically isolated from each other.

The understanding of the classification hierarchy and binomial classification was quite good, including the advantages of their use (b) and (c). The idea of classification indicating phylogenetic (evolutionary) relatedness often was not mentioned as part of the usefulness of both the classification hierarchy and the binomial nomenclature.

Students continued to have difficulty with stating distinguishing features at the order level for insects and at the family and species level for plants. Candidates often gave features which did not distinguish between different insect orders or between plant species. Students who produced a table showing the two orders or families or species and their distinctive features inevitably scored well in sections (d) and (e). Many candidates commonly failed to give features which were distinctive of plant families. An increasing number of candidates gave complex taxonomic descriptions for plant species, which were often confused and not necessarily applicable to the groups they were comparing. Study of orders, families or species from other parts of Australia, or the world, seemed to have resulted in a lack of understanding of features which could be seen and understood better by studying local examples during field work. Some candidates had failed to learn the scientific names of their plant species, part (d)(ii).

The marking scheme and a range of candidate responses for Question 35 part (e) follow.

(e)	(i)	Correct scientific family	1/2 mark
	(ii)	2 family characteristics of given family	1/2 mark each
	(iii)	Correct scientific genus for given family	1/2 mark
		Both genus and species together *(Eucalyptus saligna)*	
	(iv)	2 scientific names (genus and species must be given)	1/2 mark each
	(v)	2 correct distinguishing characteristics for both species	1/2 mark each

An example of a response scoring 3 1/2 marks:

(e)	*(i)*	*Proteaceae*		(1/2 mark)
	(ii)	*four perianth parts; two sets of leaves*		(1/2 mark)
	(iii)	*Banksia*		(1/2 mark)
	(iv)	*Banksia serrata*	*B. ericifolia*	(1 mark)
	(v)	*leaves with serrated margins* *Styles curved*	*leaves with smooth margins* *styles hooked*	(1 mark)

A 1/2 mark was lost as only one distinctive family feature was given.

An example of a response scoring 2 marks:

(e)	*(i)*	*Myrtacae*	(1/2 mark)
	(ii)	*woody tissue; long pointed leaves*	(0 marks)
	(iii)	*Eucalyptus*	(1/2 mark)
	(iv)	*Melaleuca ericifolia; Eucalyptus obliqua*	(1 mark)
	(v)	*plant height; fruit shape*	(0 marks)

2 marks given. Features not distinctive at the family level or at the species level.

An example of a response scoring 1 mark:

(e)	*(i)*	*Mertacae*	(1/2 mark)
	(ii)	*long thin leaves; showy flowers*	(0 marks)

(iii)	*Melaleuca*	(1/2 mark)
(iv)	*Callistemon (bottlebrush); Melaleuca*	(0 marks)
(v)	*Callistemon has long bottlebrush flowers*	
	Melaleuca has buds	(0 marks)

1 mark given. Myrtaceae was accepted although spelt wrongly (phonetically correct). No distinctive family features given. No scientific names (genus and species) given. No distinctive species characteristics given. Both the Melaleuca and Callistemon have bottlebrush inflorescences (flower heads) — ie not a feature which distinguishes between the two plants given.

Question 36 — The Human Species

Generally candidates showed a good understanding and all parts of the question produced a range of responses.

In part (a)(i) biological knowledge on the characteristics of mammals was poor. Part (a)(ii) asked for characteristics to classify the four animals as mammals. Many candidates gave characteristics which are common to more than one group and are thus not distinguishing characteristics.

In part (b) with reference to skeletal features, many candidates failed to use specific biological terms. For example, skull size is not acceptable if referring to differences between gorilla and man. Specific differences may be cranial capacity/size of brow ridge/position of foramen magnum, etc.

Where stimulus material is provided, as in part (c), many candidates failed to provide information beyond that presented in the stimulus material. This elective requires considerable depth of knowledge and understanding of the evidence supporting human evolution and its significance.

In part (e) many candidates did not fully explain the adaptive advantage of different physical differences. The concept of evolution and human potential to influence it in (f) were not answered well.

The marking scheme and a range of candidate responses for Question 36 part (f) follow.

(f)	(i)	Specific/named example of technology	1/2 mark
		Potential to influence human evolution	1/2 mark

An example of a response scoring 1 mark:

Through technology we can, for example, influence our own evolution through development of medicine whereby keeping ill people alive we create a larger population.

An example of a response scoring a 1/2 mark:

Technology — humans have been able to eradicate and treat deadly diseases.

(f)	(ii)	Specific/named example of agriculture	1/2 mark
		Potential to influence human evolution	1/2 mark

An example of a response scoring 1 mark:

Better agricultural techniques lead to a greater abundance of food supply which helps humans to survive better.

An example of a response scoring a 1/2 mark:

Agriculture — the use of land for agriculture and the many chemicals and pesticides used to treat pastures and crops can influence our evolution.

(f)	(iii)	Specific/named example of genetic technique	1/2 mark
		Potential to influence human evolution	1/2 mark

An example of a response scoring 1 mark:

Genetic techniques — genetic engineering has allowed scientists to change our evolution by specifying offspring and taking control over variation caused by normal meiosis.

An example of a response scoring a 1/2 mark:

Cloning can be used to control agriculture so humans can have a nourishing food supply.

(f)	(iv)	Specific/named example of birth control	1/2 mark
		Potential to influence human evolution	1/2 mark

An example of a response scoring 1 mark:

Birth control — allows humans to choose when they want children. Also offers the option of aborting foetuses with defective genes thus affecting genetic variation.

An example of a response scoring a 1/2 mark:

Birth control — contraceptives have reduced the amount of pregnancies and therefore reduced the amount of unwanted pregnancies.

Question 37 — Genes in Action

A detailed understanding was required for full descriptions of protein synthesis, genetic engineering and mutations.

Very few candidates scored full marks for part (a)(i) on why 3 bases, rather than 1 or 2 are needed to code for a single amino acid.

Genetic punnet squares were satisfactorily done, but candidates did not distinguish between genotype and phenotype. Many candidates did not know the blood group is the phenotype. Polygenic characteristics were not understood.

Many candidates repeated the stimulus materials in the question as their answer.

The marking scheme and a range of candidate responses for part (g) follows.

(g)	(i)	1. ONE example of an ethical issue	1 mark
		2. ONE scientist's response to those community concerns	1 mark
	(ii)	1. The production of human insulin by genetic engineering:	
		• restriction endonuclease (enzyme)	1/2 mark
		• cuts both bacterial plasmid and human gene for insulin	1/2 mark
		• human insulin gene spliced into bacterial plasmid and 'sticky ends' join	1/2 mark
		• plasmid is placed back into bacterium and it is allowed to reproduce	1/2 mark
		2. ONE advantage:	
		eg less or no side effects to diabetics using this genetically engineered insulin	1/2 mark
		ONE disadvantage:	
		eg if the engineered bacteria escape, will it remain harmless?	1/2 mark

(g) (i) 1. ONE example of an ethical issue

An example of a response scoring 1 mark:

1. People are worried that accidentally a dangerous microbe could be produced unwittingly by scientists. This could be let out into the population and destroy things, whilst containing a gene which allows it to survive many things, eg drought, flood. The ethical issue here is the quality and monitoring of gene manipulation.

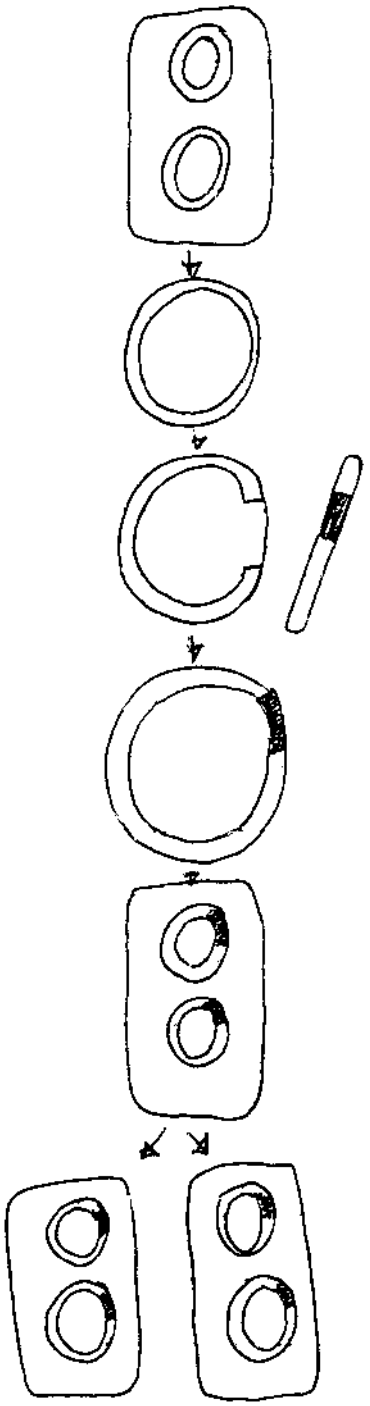
(g) (i) 2. ONE scientist's response

An example of a response scoring 1 mark

2. Scientists could respond to this concern by assuring the community that all genetic manipulations are carried out under strict controls and there is no possible way they could escape from the laboratory. Scientists could tell the community that microbes can only be grown and live on nutrient substances, eg agar.

(g) (ii) 1. Production of human insulin by genetic engineering

An example of a response scoring 2 marks:



A bacterium cell

Plasmid is isolated. A plasmid is a circular molecule of DNA in bacteria with few genes

Restriction nuclease (an enzyme) is used to cut segment from plasmid and also cut human insulin gene from segment of DNA

Gene for insulin production is spliced into the plasmid forming a recombinant DNA

Recombinant DNA is placed back into the cell and reproduce by mitosis

Formation of daughter cells that have human gene for insulin production in some of them

An example of a response scoring 1 1/2 marks:

1. Recombinant DNA gene splicing — A circular piece of DNA present in bacteria, called a plasmid is cut with a special cutting enzyme. The favourable trait is also cut with the enzyme. The plasmid and the favourable trait are mixed in a test tube and they recombine together when the plasmid is back in the bacteria, when it reproduces, the favourable trait is also reproduced.

This candidate failed to state that the human gene for producing human insulin must be removed from a human chromosome by restriction endonuclease then inserted into the plasmid.

An example of a response scoring 1 mark:

Recombinant DNA — gene cloning. The process of taking plasmids out of bacteria, then using gene spicing techniques to place human DNA in the plasmid which can then be placed back into the bacteria to reproduce. Once it has reproduced many times it can be taken out of the bacteria, the plasmid containing insulin can be removed and purified.

This candidate did not mention the use of the specific enzyme to splice both the bacterial plasmid and the human gene, so that 'sticky ends' then fit together.

An example of a response scoring a 1/2 mark:

(ii) Gene splicing allows human insulin to be propagated using bacteria cells. Human insulin is removed from the body. 'Gene shears' are used to 'splice' part of a chromosome from the bacterial organism, inserting the human insulin gene where the bacteria genes were removed. The bacteria are then allowed to reproduce and the human insulin is harvested from the colony of bacteria.

This candidate only mentioned the insertion of the human insulin gene to gain a 1/2 mark.

(g) (ii) 2. An example of a response scoring 1 mark:

Advantages –

less likely to produce allergic reactions

Disadvantages –

May create a pathogenic strain of bacteria that is resistant to antibiotics.

An example of a response scoring a 1/2 mark:

The advantages of this development

- *no side effects on diabetics who take this*
- *cheap*
- *can be produced in large quantities*

Disadvantages:

- *not everyone will respond to this synthetic insulin, in some very rare cases it could be rejected.*

All of the advantages mentioned above are correct, but there is no evidence for the disadvantage mentioned.

Question 38 — Human Environmental Impact

Candidates tended to give generalised answers and many were unable to use correctly the language of biology. Few candidates were able to give accurate and specific details in their answers, relying on sweeping statements. Candidates in this question must interpret key words such as 'define' and 'describe' and they must be able to define the terms used in the syllabus.

Many candidates did not address the questions asked. For example, in part (d)(ii), candidates could name the human activity but failed to link it to the altered population numbers.

The marking scheme and a range of candidate responses for part (e) of Question 38 follow.

(e)	(i)	Controlled burning defined	1/2 mark
		Accidental fire defined	1/2 mark
	(ii)	THREE differences stated (linked)	1 mark each
		Up to three differences (unlinked)	1/2 mark each

An example of a response scoring 4 marks:

(e) (i) 'controlled burning' — less intense, deliberate lighting of bushland areas to reduce dry undergrowth. Strictly controlled and carried out in the colder months (ie not summer).

'accidental fires' — are less frequent, extremely hot wild fires that occur in native bushland areas in hot summer months. They occur naturally — blacken natural gum trees and other plants and help in seed germination.

(ii) *Controlled burning often 'stews' native seeds as the fire isn't as hot and does not help in native seed germination whereas accidental fires are hot and intense and are responsible for helping many native species to germinate their seeds.*

'Controlled burning' occurs more frequently than 'accidental fires' and only causes the destruction of undergrowth not most or all of the vegetation (unlike accidental fires).

As a result of frequent 'controlled burnings' some native tree/plant species are disrupted as they are unable to have their seeds properly germinated. They fail to reproduce due to the prevention of 'accidental fires'. 'Controlled burns' result in the wild genetic genepool being decreased as some plant species reliant on 'accidental fires' die out

In part (i) the candidate scored 1 mark total for two correct definitions.

In part (ii) the candidate scored 3 marks for three linked differences.

An example of a response scoring 3 marks:

(e) *(i)* *An accidental fire is when lightning etc starts a fire which is not meant to be.*

Controlled burning is a fire that is deliberately lit to help the revegetation of forests.

(ii)	*CONTROLLED*		*ACCIDENTAL*
1	*Only certain parts of forest is killed*	*1*	*This would wipe out a whole forest*
2	*Animals are moved before burning*	*2*	*Lots of animals are killed*
3	*The fire will do the job it is meant to*	*3*	*This fire will wipe out anything that crosses its path*

In part (i) the candidate scored 1 mark for correct definitions.

In part (ii) the candidate scored 2 marks for two linked differences (labelled 1 and 2 by the candidate).

An example of a response scoring 2 marks:

(e) *(i)* *A controlled burning is a fire deliberately lit by the fire brigade to burn certain areas which could cause harm to people if a bushfire was to occur.*

An accidental fire is a fire that occurs accidentally. Nobody has deliberately lit it to cause a massive fire.

(ii) *Controlled burning is slowly done and can stew seeds, whereas accidental fires usually burn through the bush quickly opening seeds.*

Nature depends on, and thrives on accidental fires.

Regular controlled burning in the same areas can kill certain plants off and also allow weeds to grow more easily.

In part (i) the candidate scored a 1/2 mark for one definition of controlled burning.

In part (ii) one mark was awarded for one linked difference about the effect on seeds.

A 1/2 mark was awarded for the last statement because no comparison was made between controlled and accidental fires.

An example of a response scoring 1 mark:

(e) *(i)* *Controlled burning is done by the fire brigade annually to make fire breaks so when a fire occurs it can be stopped.*

Accidental fire is not controlled and can be a natural fire.

(ii) *Accidental fires do not happen to often allowing plants to regrow. Controlled burning is annual and does not allow plants to regrow.*

Accidental fires allow germination of many seeds. Controlled burning allows germination of the seed, then kills the seedling later.

Controlled burning controls the flames and allows houses a safety barrier. Accidental fires can start deep within a forest and can burn out of control destroying property and houses.

In part (i) the candidate scored a 1/2 mark for the correct definition of controlled burning.

In part (ii) the candidate scored a 1/2 mark for the second point made. The answer did not outline differences between accidental and controlled fires.

In the final part to the answer no effect on native forest is stated.