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EXAMINATION REPORT

Biology

Including:

- Marking criteria
- Sample responses
- Examiners' comments

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Biology

In 1997 a total of 14,214 candidates sat for the HSC Biology examination, a slight increase from 1996.

General Comments

The general standard of candidate responses was pleasing, and consistent with recent years. It is still very evident, however, 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 some 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 the information clearly. In some questions it was possible for candidates to use tables and diagram when answering. Candidates who did this 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 I: 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	15.18	61.26*	9.18	14.26
2	9.55	4.75	3.76	81.86*
3	11.52	8.47	9.22	70.65*
4	8.26	5.09	79.11*	7.45
5	4.57	90.74*	3.51	1.12
6	91.35*	1.08	3.31	4.21
7	4.08	0.92	2.47	92.45*
8	16.12	50.68*	3.45	29.66
9	11.64	60.61*	8.44	19.25
10	51.11*	2.76	10.90	35.17
11	89.97*	8.60	0.50	0.91
12	9.37	6.00	84.37*	0.22
13	89.02*	5.34	3.35	2.20
14	4.97	3.94	85.66*	5.32
15	0.54	4.77	91.82*	2.84

Question 16

This question presented no particular problems for the candidates. Most were able to list one advantage in both parts (a) and (b) and express their answers in comparative terms. The majority used factors that were listed in the syllabus. In part (c), many candidates correctly referred to the diagram on the paper in answering air spaces. However, some also referred incorrectly to intracellular air spaces or used incorrect or inappropriate terms such as air sacs, bladders and vacuoles. Many candidates did not explain the concept of density and how the plant tissues floated or presented confusing explanations.

Question 17

This question was generally well answered with the vast majority of candidates using AIDS as the example. In part (a), there was some confusion whether to name a disease or a malfunction. For those candidates who did not name AIDS, there was a full range of auto-immune and immune deficiency diseases listed. In part (b), many candidates used general terms to describe how the disease affects the immune system when the better prepared candidates gave more specific details. In part (c), some candidates did not describe 'characteristic symptoms' of the disease, instead listing very general ones. There was confusion between the symptoms for HIV and those for AIDS. There was also a small number of candidates who incorrectly defined AIDS as Auto Immune Deficiency Syndrome.

Question 18

This question was well answered by the majority of candidates. The errors that were made by candidates fell into one of three categories:

(i) a lack of understanding of ratios. A 50% chance is a ratio of 1:1 not 1:2.

(ii) a lack of understanding of probability. Although the couple already have one albino child, the chance of them having a second albino offspring is still 25% or a ratio of 1:3.

(iii) attempting to answer the question in terms of sex linkage. The majority of these candidates also showed a poor understanding of sex linkage.

Question 19

Many candidates answered this question by stating Koch's postulates rather than applying their knowledge of the postulates to the specific situation in the question. This led to many 'animals' and 'oranges' being inoculated, while other candidates inoculated healthy leaves without specifying that they were on another healthy plant.

Students again replaced the term 'micro-organism' with disease and compared a second cultured disease with the original micro-organism.

Many candidates did show an understanding of the sequence of the postulates.

Question 20

This question was generally well answered.

A majority of candidates understood how the structures provide evidence for evolution but some candidates found difficulty in expressing three separate points in their answer. Most candidates

were able to identify the similarity between the limbs or recognise that each was an example of a pentadactyl limb. Likewise, a large proportion of the candidates recognised that these similar structures gave evidence of a common ancestor.

Fewer candidates were able to explain that the difference between structures was due to adaptations to different habitats, with some confusing 'divergence' with 'convergence'.

Question 21

In part (a) most candidates were able to calculate the 3 tall : 1 short ratio of offspring. Some candidates were unable to differentiate between phenotypes and genotypes (eg stating a ratio of 3:1 without indicating phenotypes).

In part (b) most candidates successfully named an environmental factor but a large proportion had difficulty in explaining how the named factor actually led to a ratio change from 3:1 to 2:1.

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

(a) 3 tall : 1 short — 1 mark

(or 75% tall : 25% short or 3 in 4 tall : 1 in 4 short).

(b) • A named environmental factor, eg nutrients. — ½ mark

• Some tall plants received less — did not get enough of a factor, eg nutrients. — 1 mark

• The result was that fewer of the tall plants survived or some of the tall plants were stunted. — ½ mark

An example of a response scoring 3 marks:

(a) The ratio of phenotypes would be

	T	t
T	TT	Tt
t	Tt	tt

3 tall : 1 short

(b) Some of the tall offspring may not have received the required nutrients for normal growth and did not grow tall but remained stunted.

In (a) the candidate scored 1 mark for correct ratio 3 tall : 1 short. While in (b), 1/2 mark was awarded for the environmental factor — nutrients. 1 mark was awarded for acknowledging that some tall plants did not get enough/same amount of the factor and 1/2 mark for stating there would be fewer tall plants (reducing ratio from 3:1 to 2:1).

An example of a response scoring 2 marks:

(a) 75% tall to 25% short.

(b) There were not as many tall plants as expected because they live in a dry environment and did not have enough water for growth.

In (a) 1 mark for correct ratio. In (b) 1/2 mark for giving an environmental factor (water) and 1/2 mark for stating there would be fewer tall plants.

An example of a response scoring 1 mark:

(a) 3/4 tall plants and 1/4 short plants.

(b) Not enough plants were used in the experiment to get the 3:1 ratio.

Part (a) scored 1 mark for correct ratio. Part (b) scored 0 marks for not naming an environmental factor and relating this to the change in the ratio.

Question 22

Students who understood the process of natural selection scored well in this question. The usual confusion between the Darwinian and Lamarckian concepts of evolution was evident in many answers, as these candidates believed the resistance was acquired when the antibiotic was applied. A number of candidates misunderstood the question, or confused antibiotics with antibodies, and wrote about surface antigens on the bacterium changing to 'resist' the antibiotics/antibodies. Many candidates confused the term resistance with immunity.

The marking scheme and a range of candidate responses for Question 22 follow.

Variation exists **or** some bacteria resistant **or** some bacteria mutate.	1 mark
Resistant/better adapted bacteria survive.	$^1/_2$ mark
Non-resistant/non-adapted bacteria die.	$^1/_2$ mark
Resistance (gene) passed on to offspring.	$^1/_2$ mark
The population becomes resistant **or** the frequency of resistance (gene) increases **or** the process repeats for many drugs.	$^1/_2$ mark

Students had to be explicit about the variation existing or the original presence of resistant bacteria in the population so as to distinguish their explanation from a Lamarckian one. Any answers that implied the resistance was 'acquired' by the bacterium did not score the variation mark but were able to score up to 2 marks if the rest of the answer correctly explained the selection process and increase in number of resistant bacteria in the population over time.

An example of a response scoring 3 marks:

Within the original population some bacteria, by chance, were resistant to the antibiotic. These resistant bacteria survived and the non-resistant ones died. The surviving bacteria passed on the resistance to their offspring and over time the process repeated for each drug so the whole population ended up resistant to many different antibiotics.

This answer shows an understanding of the selection process acting on existing variations and the need for the characteristic to be heritable. The candidate has given two alternatives to get the final 1/2 mark but can only score it once.

An example of a response scoring 2 marks:

MRSA develops because a few bacteria are naturally resistant to antibiotics and these survive while the non-resistant ones die off.

This answer does not take into account the passing on of the resistance and the resultant increase in frequency of resistance in the final population.

An example of a response scoring 1 mark:

The resistant bacteria survive and they pass this resistance on to their offspring.

This answer does not explain that variation existed in the original population, or state that the non-resistant bacteria die, or describe the increase in frequency of resistance in the final population.

Question 23

This question was testing the mandatory experience of an analysis of statistical data on the incidence of a disease. Students had great difficulty answering the question as, rather than being given data to analyse, they were asked to recall data they had investigated in class and, without presenting it, draw conclusions from it. Very few candidates were able to do this successfully.

In part (b) a 'conclusion' was deemed to be any comparative statement about the incidence (eg. higher/lower/more prevalent) of a stated disease in a stated group. Two such 'conclusions' scored two marks. If candidates did present data and drew two valid conclusions from this they also scored two marks.

A number of candidates did not read the question properly and simply answered the question they expected to get, that is, one that asks them to name a disease and state the cause, symptoms, treatment and/or control measures for this disease. In some cases these candidates were still able to score marks in part (c). Others answered with the historical information they had learnt as one of the other mandatory experiences in the Human Disease core topic. In some cases these candidates were able to score marks in (b) and/or (c) if they discussed increases or decreases in incidence over time.

In part (c) candidates had to explain how the incidence of the disease could be lowered, so specific control measures (not just education/making people aware) were required to score marks. A general answer about the use of disease statistics to control disease incidence scored 1/2 mark and an answer specific to controlling the disease they named scored 1 mark, since the question asked them about the incidence of 'this' disease (ie the one they had named). Students could score full marks whether they discussed an infectious or non-infectious disease.

The marking scheme and a range of candidate responses for Question 23 follow.

(a)	Naming the disease.	0 mark
(b)	Two statements, either qualitative or quantitative, of disease incidence in specified groups.	2 marks

OR

Two valid conclusions from one stated set of data.

(c) A reasonable and specific explanation relating to reducing incidence of the disease, relating to group or population level. 1 mark

Of the form: Change habits to control incidence.

Treat stated group (drugs/therapy/health care).

Screen group at risk.

Control measure specific to region/environment.

For a general statement relating to identification of risk factors or causes and treating or screening the group at risk. $^1/_2$ mark

A statement of the percentage of people in certain groups (or the world) suffering from a particular disease did not score marks unless two groups were compared (eg 20% of males and 40% of females). The description of areas where the disease occurred did not score marks unless it was made clear that incidence is higher in these areas.

An example of a response scoring 3 marks:

(a) Lung cancer.

(b) The incidence of lung cancer is increasing. 1 mark

More smokers than non-smokers suffer from lung cancer. 1 mark

(c) People can be encouraged to stop or reduce smoking by the government providing Quit programs for smokers, using nicotine chewing gum and nicotine patches, etc. Passive smoking can be decreased by making more restaurants and other public places non-smoking areas. 1 mark

Both statements in (b) are comparative — the first in the temporal sense and the second comparing two specific groups.

An example of a response scoring 2 marks:

(a) Down's syndrome.

(b) Greater incidence in children born to women over the age of 40. 1 mark

(c) Women over 40 can be tested by amniocentesis and then decide to abort the child if it is positive for Down's. 1 mark

Only one conclusion given in (b) so scored only 1 mark. The answer in (c) is specific to Down's syndrome and will reduce the incidence of the disease.

An example of a response scoring 1 mark:

(a) Lung cancer.

(b) Incidence of lung cancer is higher in males than females. 1 mark

Lung cancer is caused by smoking. 0 mark

(c) People can be educated about the risks of smoking. 0 mark

Stating the cause without specifying a group or incidence of the disease scored no marks. Educating people about the risks will not necessarily reduce the incidence of the disease so scored no marks.

An example of a response scoring 1/2 mark in (c):

(c) By knowing which groups are most at risk these can be treated with appropriate drugs or vaccines to decrease incidence of the disease.

This is a general statement, not specific to a particular disease, so scores 1/2 mark.

Question 24

In part (a) most candidates were able to describe opening and closing of the stomates but some did not refer to the full period of the graph. Most candidates gave only a broad description of stomate action but better candidates described the graph in selected time periods.

In part (b) the significance of stomates for controlling water loss and enabling diffusion of gases was well understood. A frequent unacceptable response confused sunlight opening the stomates with control of water balance.

In part (c) most candidates understood that the stomate would open wider but as in (b) some candidates provided answers related to light intensity rather than water availability.

Question 25

Candidates were generally able to name three structural or physiological changes necessary for life on land. Explanations of the need for the changes were not specific enough or not clearly expressed by some candidates. Most responses used vertebrate adaptations as examples.

Part C

Question 26

Generally, part (a) was well answered. The majority of the incorrect responses did not refer to the specific point in time required for in the answer.

Most candidates were able to use descriptive language in their responses along with the appropriate time frames in (b). Most of the errors in the part came from responses that failed to use the correct time frame or did not acknowledge that there was some increase in growth during week one and/or weeks four to six.

Part (c) revealed that the majority of candidates were able to identify and explain the function of a control in an experiment. The better responses were able to refer their answer to the particular experiment in the question. Students demonstrated a general inadequacy in formulating a hypothesis in part (d). The majority of the responses were reasons for the pattern of growth rather than hypotheses that could be tested. Some candidates obviously found it difficult to formulate an hypothesis, which encompassed the three changes in the growth pattern, indicated on the graph for ‘X’.

Regarding part (e) very few candidates were able to design experiments significantly different from the one outlined in the question. However, the basic principles of experimental design, for example a control, large numbers of subjects, measuring results etc, were generally present in most answers.

The marking scheme and a range of candidate responses for Question 26 follow.

(a) A precise point in time on the time axis needs to be indicated; ½ mark

eg three weeks after the start of the experiment/In three weeks/At the end of week 3.

(b) For the maximum marks, the following areas of the graph need to be identified in the correct time period. 1 mark

- Slow growth during week 1.
- Rapid growth indicated somewhere during weeks 2 and 3.
- Slow growth after week 3.

ANY two of the above 1/2 mark.

(c) An extended description of what 'Y' does as a control in THIS experiment. 1 mark

OR

A general description of the function of 'Y' as a control. ½ mark

(d) A clearly defined hypothesis, relevant to the graph and the experiment, and reference specifically to either mice or the food additive. 1 mark

Correct hypotheses relating to growth rate but no reference to mice. ½ mark

OR

Hypotheses that suggest that the mice simply became adapted to the food additive.

OR

Explanations, conclusions, aims.

(e) Maximum marks were awarded for the following four points: 1 ½ marks

- Two or more groups with a difference in only one variable.
- An indication of more than one organism per group.
- Mention of controlling at least one variable across the experiment.
- How the results are measured.

ANY 3 of the above 1 mark; any 2 of the above 1/2 mark.

An example of a response scoring 5 marks:

(a) After 3 weeks.

(b) Weight slowly increases during the first week, over the next week it increases very rapidly, between 2nd and 3rd week, weight is increased a little slower, but still rapidly. From week 3 onwards, weight is gained slowly.

(c) Because they are the control group, to make sure it's the additives, not the food, which is causing rapid growth.

(d) When mice are fed on a certain food additive their growth rate increases rapidly.

(e) Use 300 mice, of the same species and age. Feed 100 mice with food containing no additive. Feed another 100 mice the same food containing a food additive. Feed another 100 mice the same food containing a different food additive. Weigh the mice after each week recording results on a graph. Continue experiment for 6 weeks.

In (a) the precise point in time is correctly identified. In (b) the growth pattern is correctly described for group 'X' in each of the three areas indicated in the marking scheme. In (c) the purpose of group 'Y' in the experiment is correctly explained.

An acceptable hypothesis is given in (d) and an experiment, significantly different to the one in the question, is designed to test this hypothesis in part (e) including all the four indicators in the marking scheme.

An example of a response scoring 4 marks:

(a) 3 weeks after the start of the experiment.

(b) Week 1 grew steadily and slowly, week 2 grew rapidly (and a lot), week 3 growth rate slowed a little, but still a lot of growth. Week 4 – 6, growth slowed a lot and the mouse only grew a little (as in week 1). Slow/rapid/less rapid/slow.

(c) Group 'Y' is a control. It is so the growth of mice with food additive can be compared to growth without. So it can be seen if and how additives affect growth rates.

(d) The food additive once in the system, caused the mice to grow rapidly to their adult size. Once they had almost fully grown, its effect was no longer needed.

(e) With 50 young mice, divide them randomly. Feed 25 with food additive in their food and 25 with same food without additives. Weigh all animals regularly and take average. Also test to how much food additive is in the blood of the first 25 mice. This would be done until all mice are fully grown. Then additive amounts compared.

The response scored full marks for (a) as it correctly identified where the greatest difference in average weights occurred precisely. The response scored full marks in (b) as it adequately describes the three areas of the graph suggested in the marking scheme within the correct time periods. Full marks were also scored in (c) as the response is an extended explanation of the function of 'Y' in this experiment as a control. The response scored half a mark for (d), as it is an explanation of the results rather than an hypothesis.

An example of a response scoring 3 marks:

(a) At 3 weeks after the beginning.

(b) Small increase in weight over the first week, then weight increases quickly for the next week, slowed gradually after that, but still increasing, and then increased slowly for the remaining three weeks.

(c) It is necessary to include Group 'Y' as a control, to observe the results without the food additive as a comparison.

(d) The mice increased weight because of the food additive, but increase slowed as they reached a maximum possible weight.

(e) Complete the same experiment as described in the question but with a different sized species of mouse. Observe growth pattern.

Maximum marks were scored for (a), (b) and (c) as the responses fulfilled the requirements of the marking scheme. Only half a mark was awarded for (d), as the response is an explanation rather than an hypothesis. No marks were given for the response in (e).

An example of a response scoring 2 marks:

(a) At the 3 weeks point.

(b) The first week had little effects. From weeks 2 to 3 there is a rapid increase. Weeks 3 to 6 only show a slight increase.

(c) Group 'Y' are needed to show the comparison between each group to see if the experiment works.

(d) The additive has caused group 'X' to rapidly gain weight.

(e) Do the same experiment. Then stop feeding the 'X' group with the additive, give them normal food, no additives for 6 weeks. Repeat the first experiment and compare the results.

Full marks were awarded to (a). Part (b) only scored half a mark, as only 2 of the 3 areas required on the marking scheme were present in the response. Part (c) scores only a half as it fails to refer to the group with the food additive or to group 'X' as a comparison. The response for part (d) also scores only a half, as it is a conclusion rather than a hypothesis. It also does not refer specifically to mice. No marks were awarded for part (e).

An example of a response scoring 1 mark:

(a) At the beginning of the third week.

(b) 'X' is constantly gaining weight.

(c) Group 'Y' was the control.

(d) The food additive increases the growth rate for a short period.

(e) Set up the same experiment with a young mouse to observe the rapid increase in weight.

Both (a) and (b) score zero, as the responses are both incorrect statements. Part (c) scored half a mark as it only refers to 'Y' as 'the control'. Part (d) also scored half a mark for although it is a relevant hypothesis it does not refer specifically to mice. No marks were awarded to part (e).

An example of a response scoring 0 marks:

(a) 'X' mice have the greatest advantage in weight at 34 grams.

(b) The pattern was slow, fast, slow.

(c) It is necessary to include group 'Y' mice to see if the experiment would work.

(d) The 'X' group of mice have grown more than the 'Y' group of mice.

(e) Give one group an additive and the other group no additive.

This response scored zero as the answers for (a), (b), (c) and (d) fail to comply with the marking scheme. Although the response in part (e) does raise one relevant point from the marking scheme, two are needed to score at least a half.

Question 27

Part (a) (i) was generally well answered with most candidates being familiar with behavioural adaptations of desert animals. In part (a) (ii) the candidates were mostly able to give an example of a structural adaptation. However, many were unable to explain how it maintained a lower core temperature. Part (a) (iii) was generally answered poorly. The majority of candidates had little knowledge of physiological adaptations to maintain lower core temperatures. Some candidates could give an example but were unable to explain how it operated. Many candidates confused temperature control and water balance. In many instances, the specific question was ignored with candidates answering with examples of how desert animals conserved water.

Part (b) was generally well answered by most candidates. Most could give two examples of structural adaptations of plants and could explain how they reduced water loss in desert plants.

The marking scheme and a range of candidate responses for Question 27 follow.

(a) EXPLAINED:

(i) **Behavioural** adaptation of animal. ½ mark

How it attempts to maintain a lower core temperature. ½ mark

(ii) **Structural** adaptation of animal. ½ mark

How it attempts to maintain a lower core temperature. ½ mark

(iii) **Physiological** adaptation of animal. ½ mark

How it attempts to maintain a lower core temperature. ½ mark

(b) DETAILED:

FIRST example of:

Structural adaptation. ½ mark

How it reduces water loss from leaves. ½ mark

SECOND example of:

Structural adaptation. ½ mark

How it reduces water loss from leaves. ½ mark

An example of a response scoring 5 marks:

(a) (i) Burrow underground where it is cooler than the atmosphere above.

(ii) Large ears radiate heat and allow rapid heat loss due to a large SA.

(iii) Vasodilation — blood vessels close to surface become engorged with blood to radiate excess heat to the environment.

(b) Sunken stomates trap moist air and provide a humid environment thus reducing water loss. Leaves reduced to spikes have a low SA, therefore less water is lost from the leaves via transpiration.

Each part of the answer included both a suitable adaptation plus an explanation of its benefit.

An example of a response scoring 4 marks:

(a) (i) By burrowing the animal avoids the heat of the day.

(ii) Desert animals have a high surface area to volume ratio which allows them to expel heat quickly.

(iii) Desert animals may dilate blood cells in their extremities to expel heat by vasodilation.

(b) Leaves reduced to thorns or spines provide a smaller surface are for a transpiration and water loss to occur, and hairy leaves can reflect the sun's rays.

This response provided a less than specific explanation of the adaptations in (a) (i) and (b) and so was not awarded maximum marks.

An example of a response scoring 3 marks:

(a) (i) Lying out of the sun in the hottest part of the day.

(ii) Have a large SA:V ratio for decreased loss of water.

(iii) Panting and sweating causes a cooling down effect on the body.

(b) The leaves have a waxy coating to prevent water loss. Leaves also have tiny hairs which trap the moisture and prevent loss of water by evaporation.

In part (a) only an adaptation was given but no explanation. Full marks could not be awarded. In (b) two adaptations were given. However, only detail for one was provided and so full marks were not awarded.

An example of a response scoring 2 marks:

(a) (i) They may stay in the shade or a water environment.

(ii) Their body may be relatively small.

(iii) Their colour may be light, so not to attract the sunlight.

(b) The stomates are smaller during the day. Stomates are situated on the bottom of the leaves so not in direct exposure to the sun.

No marks were awarded to (a) (iii) and the first part of (b) as the responses were incorrect. Half marks were awarded to (a) (i) and (ii) as an adaptation only was provided. The second part of the answer in (b) gave a satisfactory adaptation and explanation gaining full marks.

An example of a response scoring 1 mark:

(a) (i) By hiding from the sun in dens or caves.

(ii) The ability to store water (camel). No sweat glands.

(iii) Hibernation, nocturnal.

(b) Little leaves, become dormant in the hotter months until water (wet season) comes.

Two adaptations only were provided in (a) (i) and (b) thus gaining one mark.

An example of a response scoring 0 marks:

(a) (i) A lizard that uses the sun to heat up during the day then burrows at night.

(ii) Animals with thicker coats during the winter.

(iii) Cactus that only open their flowers at night to prevent water loss.

(b) The leaves being solid with less surface are to lose water. A storage for water.

No correct adaptations or explanations were provided.

Question 28

The question was generally well answered and candidates demonstrated a good knowledge and understanding of the topic. This question was not attempted by about 5% of candidates.

Part (a) was generally well answered. Some candidates repeated the genotype (XR Xr, XR Xr, Xr Y, Xr Y) and some wrote every possible combination. Some candidates tended to use the gene symbol separate from the chromosome symbol. Some candidates wrote only the phenotype of the offspring.

Part (b) was also generally well answered. The most common error was to declare that 25% of males would be red eyed, rather than 50%. This seems to stem from a failure to differentiate between number of male offspring and total number of offspring. Most mistakes in the working related to transcription errors and to candidates not using the XX, XY system of indicating males and females, but creating their own symbols (Ss, Rr etc)

In the explanation section of part (c) most candidates indicated that they would mate a red eyed female with a red or a white eyed male. Some candidates said they would mate the female with another female. Many errors stemmed from candidates declaring that they would carry out some microscopy or DNA study of the chromosome(s).

Some candidates confused homologous with homozygous. The most common error was to incorrectly identify red/white eyed male as homozygous or heterozygous individuals. Some candidates only predicted one outcome, either homozygous or heterozygous and many candidates failed to explain that in order to declare the female a probable homozygous, the offspring sample must be large enough to be statistically significant.

In the explanation, the majority of errors was due to transcription errors or errors of consistency. For example, explaining that the female would be mated with a white eyed male then using a red eyed male in the punnet square. Some candidates produced two punnet squares in which, rather than examining the possible outcomes of mating a heterozygous or a homozygous female with a known male, they mated only the homozygous female with both red and white eyed males. Some candidates failed to produce two punnet squares, one for the heterozygous and one for the homozygous outcome.

A significant proportion of candidates did not use percentages for possible outcomes, many choosing to discuss individual punnet squares results or small groups of offspring. In general, in part (b) and (c), candidates using the punnet square technique to calculate the outcomes, rather than alternative methods, performed better and made significantly fewer mistakes.

Question 29

Overall, this question was reasonably well answered with the correct information clearly explained using appropriate biological terms.

In part (a) many candidates did not set out their answers in a logical sequence, resulting in confusion over which 3 types of white blood cell they were nominating. Some failed to give the different types of white cells — instead they gave mixed examples of 'sub-sets' of general cell types, eg antigen/antibody/antibodies, and plasma/plasma cells/platelets. A number of candidates gave information about the cell's site and method of production rather than a specific role/function.

In part (b) many of the candidates neglected to link their answer to the process of immunisation; thus roles of white cells were, at times, poorly described. Some candidates were not familiar with antibody production in response to a specific antigen and the consequent role of memory cells and their part in future protection.

Question 30

The answers to part (a) were too superficial. Many candidates were able to answer it from their general knowledge and therefore failed to show their knowledge of Biology.

In part (b) very few candidates gave a good explanation of the advantage of an oxygen reserve.

For part (c) (i) candidates could correctly say that an advantage was to allow more oxygen being available for the brain and spinal cord. For part (c) (ii) some candidates answered the question without considering the stimulus material and so discussed the effect of blood flow at levels above normal. The most disappointing aspect of answers to this question was the number of candidates who confused the spinal cord with the vertebral column.

In part (d) most candidates gave the effect of buoyancy for their answer. A few gave good explanations of 'the bends' and even fewer gave an indicator of the effect of carbon dioxide on the breathing reflex.

The marking scheme and a range of candidate responses for Question 30 follow.

(a)		All three of the following: • increase in pressure • decrease in temperature • decrease in light. Any one of the above 1/2 mark each, **OR** Any two of the above without indicating the nature of the change.	1 mark ½ mark
(b)		Good explanation of need for reserves of oxygen. Superficial explanation.	1 mark ½ mark
(c)	(i)	Conserves oxygen; or ensures a steady supply of oxygen; or oxygen available for other organs/tissue; or conserves blood sugar; or Conserves energy; or heat loss reduced; or prevent cramp; or prevents lactic acid build up. Any one of the above Extended explanation of one chosen factor.	 1 mark ½ mark
	(ii)	Brain needs oxygen; or effect of brain not getting enough oxygen; or brain needs energy; or brain affected by not getting energy. Any one of the above. Any correct effect.	 ½ mark ½ mark
(d)		Extended explanation of the bends. Superficial explanation of the bends. **OR** For reduced buoyancy. Extended explanation. **OR** Decrease CO2, providing it is not followed by an incorrect explanation. Keeping CO2 below threshold for breathing reflex.	1 mark ½ mark ½ mark ½ mark ½ mark ½ mark
TOTAL			**5 marks**

An example of response scoring 5 marks:

(a) In deep water there would be no light on the ocean floor (light can only penetrate a max of 300m). Pressure of water increases with depth as does buoyancy.

(b) Seals are mammals that must surface to breathe. By introducing oxygenated blood from the spleen into blood stream, seal can remain underwater for longer periods of time without surfacing for oxygen needed for respiration and functioning of cells.

(c) (i) Help conserve energy and O2 as it won't be used in muscle cells. Restricting bloodflow to outer areas also conserves body heat.

(ii) If blood to the brain and CNS were reduced the seal may not be able to react or respond to danger etc as nerves would not have enough O2/blood to function. Restricting blood flow to the head may result in brain damage as cells denied oxygen.

(d) Excess air in the lungs may increase buoyancy making it difficult for the seal to reach great depths.

(a) Increase in pressure. No light, (with indication of change in depth).

(b) Can remain underwater for longer. Oxygen needed for respiration.

(c) (i) Conserve energy/Conserve Oxygen/Conserve body heat.

(ii) Brain damage results from lack of oxygen.

(d) Air gives increased buoyancy. Making it difficult to dive deep.

TOTAL **5 marks**

An example of a response scoring 4 marks:

(a) The intensity of the light would decrease and the pressure would increase.

(b) Oxygen is needed for respiration and the process of respiration provides energy that is used to keep the seal warm.

(c) (i) The blood helps to keep the seal warm so the blood is kept away from muscles which are near the surface of the animal.

(ii) The brain and the spinal cord are important for coordinating body processes.

(d) Air is less dense than water so if the seal still has air in its lungs its ability to dive is decreased.

(a) Decrease in intensity of light.

Increase in pressure.

(b) Good explanation of need for reserves of oxygen.

(c) (i) Heat loss reduced (because blood is kept away from the surface of the animal).

(ii) Role of brain and spinal cord.

(d) Extended explanation of the effect of expelling air that is less dense than water (increased buoyancy).

TOTAL **4 marks**

An example of a response scoring 3 marks:

(a) A change in temperature and air pressure.

(b) This helps the seal gain more oxygen instead of relying on the dissolved oxygen in the water — this creates energy.

(c) (i) More blood to brain and spinal cord to keep the rest of seal functioning. It doesn't waste energy and heat in muscles.

(ii) The flow keeps the seal functioning properly.

(d) This is to reduce the seal's buoyancy so they can dive faster due to increased density.

(a) Two factors that change without indicating the nature of change.

(b) Superficial indication of role of oxygen in energy transfer.

(c) (i) Indication of conserving energy. Indication of making blood available to other tissues.

(ii) Too vague.

(d) Reduced buoyancy. Dive faster.

TOTAL **3 marks**

An example of a response scoring 2 marks:

(a) Pressure — Greater pressures at depth. There is little to no light at depths.

(b) The red blood cells have oxygen so oxygen is released into the blood.

(c) (i) The blood flow contains oxygen so the oxygen is at the parts where it is needed most.

(ii) Their brain needs the right amount of oxygen.

(d) The seal does not need the air because the lungs fill up with water.

(a) Increase in pressure. Decrease in light.

(b) Too vague.

(c) (i) Oxygen available for other tissues.

(ii) Brain needs oxygen.

(d) Incorrect statement.

TOTAL **2 marks**

An example of a response scoring 1 mark:

(a) Temperature change, further down the warmer it is. Viscosity.

(b) Reduce size of spleen, reducing surface area — reducing buoyancy.

(c) (i) Saving oxygen that is not needed for later in journey — when needed. (ii) Otherwise seal would not survive, oxygen is needed for survival which is present in the blood stream.

(d) To decrease buoyancy.

(a) Incorrect statement about temperature change. Viscosity not accepted.

(b) Incorrect Statement.

(c) (i) Indication of conserving oxygen.

(ii) Too vague.

(d) Decrease buoyancy.

TOTAL **1 mark**

An example of a response scoring 0 marks:

(a) 2 changes — water depth and many marine animals in water.

(b) The advantage is to allow the animal to breathe.

(c) (i) Allows muscles just to relax.

Question 31

The majority of candidates answered this question well. In part (a) better answers noted that a non-infectious disease was not caused by a pathogen, however, few candidates defined the term disease. A significant number of candidates indicated that noninfectious disease could only be caused by genetic factors.

In part (b) most candidates were able to describe the cause, symptoms and control of two non-infectious diseases however a small number of candidates described infectious diseases. Better answers described diseases for which there was a known cause and had several clearly defined symptoms and controls. Some candidates described a factor associated with the cause of a disease but did not give the basic cause of the disease. Acceptable responses for disease control included controls, which acted at the whole population level, as well as treatments that controlled the disease.

Question 32 — The Australian Environment

The question was generally well answered by most candidates and the standard of Biology was sound. Many candidates responded in detail to parts (a), (b) and (c) but did not give parts (d) and (e) the same attention even though they were of almost equal marks.

In part a) the majority of candidates could correctly name marsupials and give their distribution. However, some candidates did not give a specific name of a marsupial; for example, kangaroo instead of red kangaroo or eastern grey kangaroo. Candidates that used maps conveyed the distributions more accurately than those that described them. Candidates were confident in discussing the effect of climate and human activities but often referred to abundance rather than distribution. Many candidates had difficulty with topography.

Candidates showed good knowledge of Continental Drift in part (b) but had difficulty linking the distribution of Lorenthaceae to its Gondwana heritage. Candidates also had problems with describing the effects of climatic change on the evolution of Australian flora and fauna in part (b) (iii).

Part (c) was well answered by the majority of candidates. Some candidates responses would be improved by using ecological terms, eg competition, predation, population changes, resources.

In part (d) (ii) many candidates had difficulty in interpreting the question and often confused physical and chemical factors. The different stages and processes (eg fertilises, lays, grows,) of the animal life cycles in (d) (iii) were not conveyed clearly by many candidates.

The majority of candidates answered part (e) well. Some candidates described the techniques of transects, quadrats and capture/recapture rather than answering the question.

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

(b) (i)	The concept of Gondwana or lands once joined then drifted apart.	½ mark
	The concept of a common ancestor or growing in Gondwana before the land masses drifted apart.	½ mark
(b) (ii)	The concept of Australia drifting north/towards equator.	½ mark
	Becoming warmer and drier.	½ mark
(b) (iii)	Any two of the following concepts (1/2 mark each).	
	Flora and fauna more adapted to dry and/or warmer conditions.	½ mark
	Extinction of various species.	½ mark
	Species more diversified or adapted to more specific environments.	½ mark

An example of a response scoring 3 marks:

(b) (i) The continental drift theory states that about 105 million years ago there once existed a large land mass called Gondwana consisting of Australia, Sth America, Africa, India and New Zealand. The mistletoes were growing on Gondwana before the land masses began to gradually split slowly moving them to their present position.

(b) (ii) As Australia gradually separated from Gondwana and later other southern continents such as Antactica, it moved to different positions and experienced different conditions. Australia experienced wet and cool conditions but as it moved north the climate changed to dry and warmer conditions.

(b)) (iii) Much flora and fauna that were adapted to cooler and wetter conditions have become extinct like some large marsupials and the restriction of rainforests. The desert conditions of central Australia have developed flora and fauna that are adapted to the drier and warmer climate.

The candidate gained full marks in part (b) (i). A 1/2 mark for each explanation; that is, continents once joined then drifted apart and the mistletoe were growing on Gondwana before the split.

In (b) (ii) two 1/2 marks were awarded for drifting north and becoming warmer and drier.

In (b) (iii) the two 1/2 marks were awarded for extinction of some organisms and more adapted to drier/warmer climate.

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

(b) (i) At some stage the southern hemisphere continents were joined but then separated.

(b) ii) Australia's latitudinal position has changed as the tectonic plates that it sits on move. This has caused Australia to become hotter and drier.

(b) (iii) The flora and fauna had to undergo evolutionary adaptations to survive in a hotter, drier climate.

The candidate gained 1/2 mark in (b) (i) for mentioning the continents were once joined then separated but did not link in the common ancestor concept.

In (b) (ii) the candidate scored a 1/2 mark for the hotter climate. Although the candidate mentioned the plates move, a direction was not given and they did not score the second 1/2 mark.

In part (b) (iii) the candidate only scored the 1/2 mark for adaptations to a hotter/drier climate.

An example of a response scoring 1/2 mark.

(b) (i) The continents were once all joined and then drifted apart.

(b) (ii) Australia split from Gondwana and is now in isolation being surrounded by water.

(b) iii) Due to the climate changes Australia's rainforests have retracted to the east coast of Australia.

The candidate gained 1/2 mark for the explanation in (b) (i).

No marks were awarded in (b) (ii) as the candidate did not give the direction of movement of Australia.

In part (b) (iii) the candidate did not answer the question on evolution of flora and fauna, no marks were awarded.

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

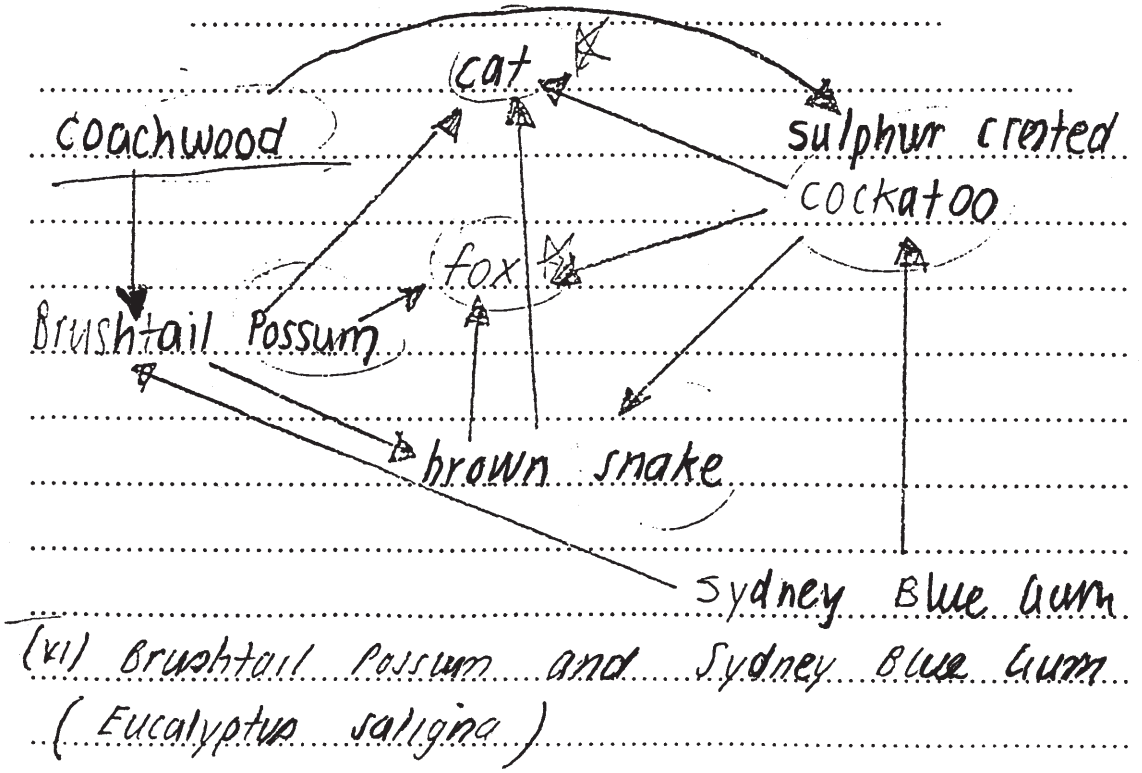
(d) (v) Food web in the candidates studied ecosystem showed:

- at least five organisms — 1 mark
- four organisms only — ½ mark
- a plant used — ½ mark
- arrows in the correct direction AND branching — ½ mark
- two introduced species. — ½ mark

(d) (vi) two indigenous species. — ½ mark

An example of a response scoring 3 marks:

(d) (v)

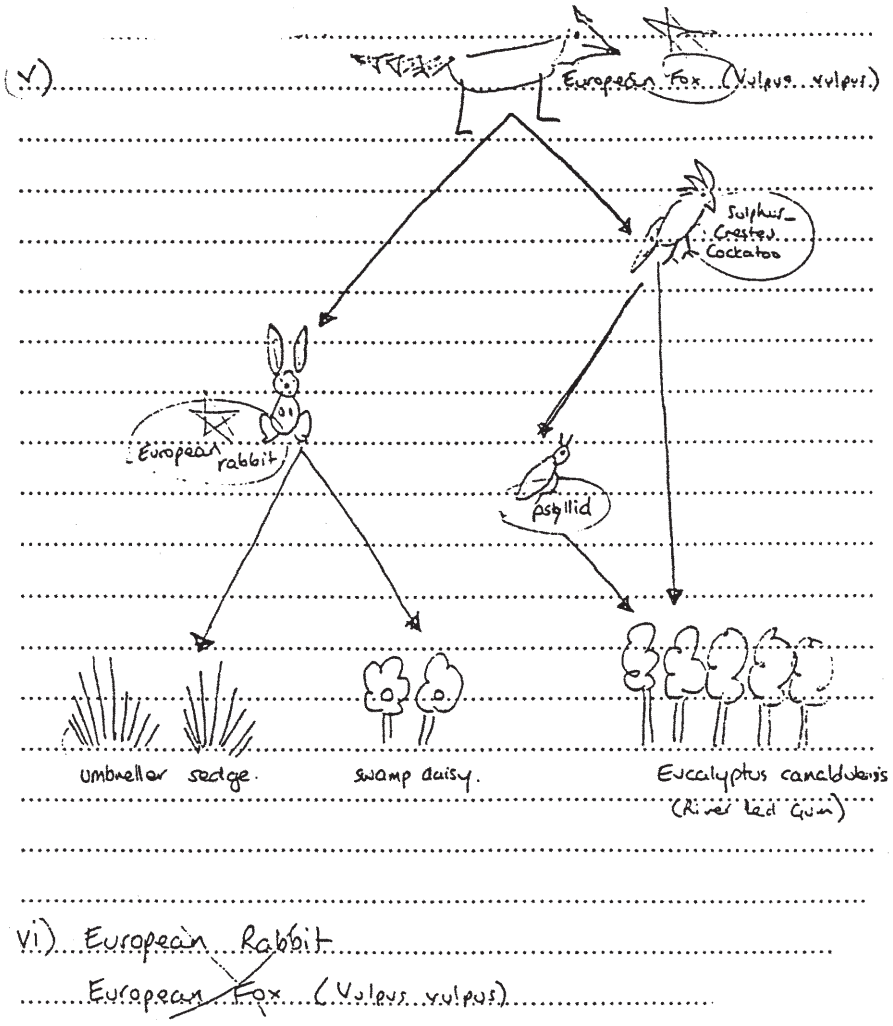


(vi) Brushtail Possum and Sydney Blue Gum (Eucalyptus saligna)

The candidate gained 1 mark for including 5 specific organisms, a 1/2 mark for including a plant (Sydney Blue Gum), a 1/2 mark for arrows branching and in the correct direction, a 1/2 mark for the two introduced organisms (fox and cat). In (d) (vi) the response scored a 1/2 mark for two correct indigenous organisms.

An example of a response scoring 2 marks:

(d) (v)

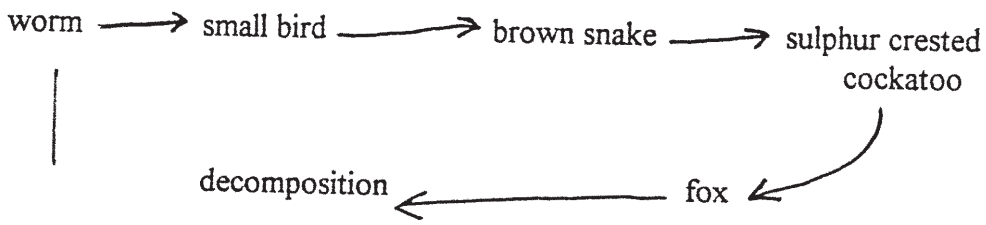


(vi) European Rabbit, European Fox (Vulpus vulpus)

The candidate gained 1 mark for five specific organisms, a 1/2 mark for including a plant and a 1/2 mark for including two introduced organisms. A 1/2 mark was not awarded for arrows in wrong direction. In (d) (vi) two incorrect indigenous organisms were named and the 1/2 mark was not awarded.

An example of a response scoring a 1/2 mark

(d) (v)



(d) (vi) Cockatoo and brown snake.

No marks were awarded for the food web. Organism names need to be specific. For example; insects, birds and fish are too general and do not indicate whether they are a herbivore or carnivore. The arrows lacked branching and represented a food chain not a food web. A 1/2 mark was awarded in (d) (vi) for two indigenous organisms.

Question 33 — Structure and Function of Cells and Tissues

The question was answered quite soundly by most candidates, demonstrating a good grasp of the biochemistry involved.

In part (a) the overall standard of diagrams showing chloroplast ultrastructure was quite poor, lacking detail of the enclosed membranes in the grana and lamellae. Most candidates correctly identified the site of light reactions and carbon fixation.

Part (b) represented a different approach to the processes of photolysis and the calvin cycle. Many candidates could not identify the source of oxygen in each case.

Part (c) was well answered by most candidates, with the hydrogen attachment to NAD in the Krebs cycle in (c) (v) the most poorly answered section.

Part (d) showed that candidates have difficulty in clearly explaining enzyme specificity. Many candidates use the word ‘specific’ in their answers. The concepts of catalysis in (d) (iii) and the effect of pH (d) (iv) were also not well understood.

Part (e) was well answered by candidates with most candidates presenting clearly labelled diagrams and stating correctly the functions of their labelled regions.

Part (f) was again well answered by most candidates with the exception of (f) (i). Many candidates failed to give two clear comparisons but gave unlinked plant and animal characteristics.

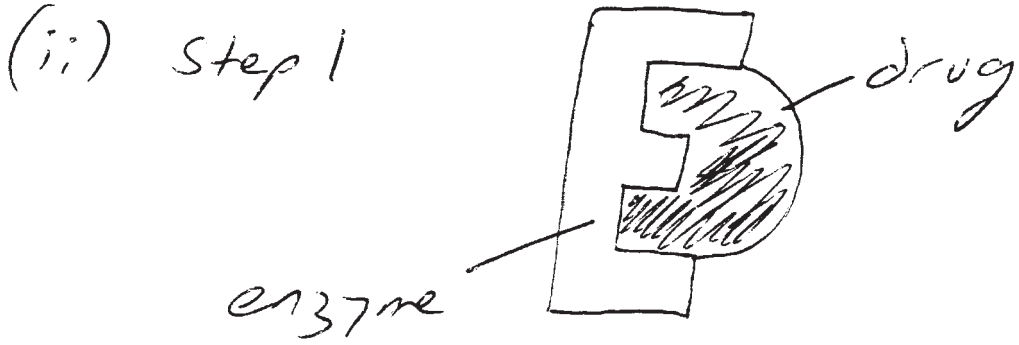
The marking scheme and a range of candidate responses for Question 33 part (d) follow.

(i)	One enzyme/one substrate well explained.	1 mark
	Poorly explained.	½ mark
(ii)	Drug binds to active site well explained.	1 mark
	Poorly explained.	½ mark
	Substrate unable to be metabolised well explained.	1 mark
	Poorly explained.	½ mark
(iii)	Catalysis well explained.	1 mark
	Poorly explained.	½ mark
(iv)	Reaction rate decreases + correct reason well explained.	1 mark
	Decreases only (no reason).	½ mark
TOTAL		**5 marks**

An example of a response scoring 5 marks:

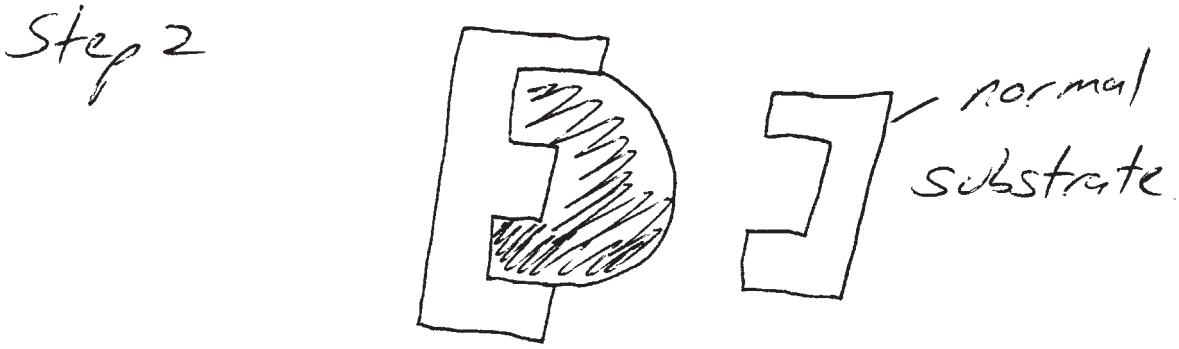
(d) (i) One enzyme is able to catalyse one substrate only.

(ii) Step 1



The drug is able to bind to the enzyme's active site.

Step 2



The normal substrate is unable to attach to the enzyme and is not metabolised.

(iii) Enzymes remain chemically unchanged after catalysing their substrate. Therefore enzymes can be re-used.

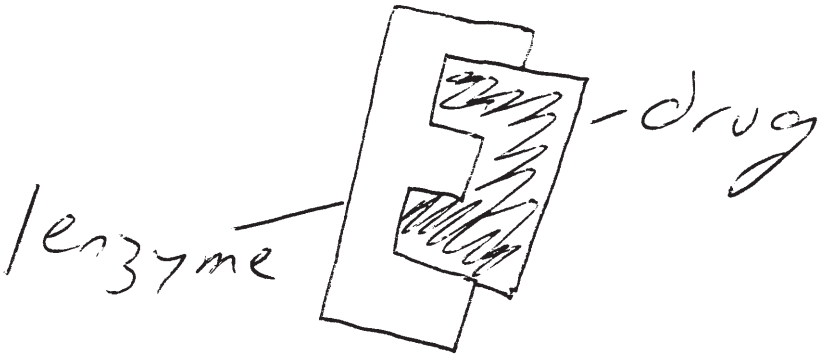
(iv) The reaction rate would decrease because the low pH in the stomach would denature the amylase.

The answer scored (1 mark) in (d) (i) for a good explanation of enzyme specificity. The diagrams and explanations in (d) (ii) (2 marks) clearly indicate the mechanism of enzyme inhibition. Catalysis in (d) (iii) is clearly explained (1 mark). The decrease in reaction rate for (d) (iv) is supported by a well explained reason (1 mark).

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

(d) (i) The enzyme fits its substrate like a lock and key.

(ii) The drug fits into the active site.



(iii) Enzymes are not part of the reaction.

(iv) The reaction rate would decrease.

This answer scored (1/2 mark) in (d) (i) for mention of 'lock and key' only. Part (d) (ii) received (1 mark) for the drug binding to the active site. The poor explanation of catalysis scored (1/2 mark) and (1/2 mark) was scored for decreased rate only in (d) (iv).

An example of a response scoring 1 mark

(d) (i) Enzymes are specific to their specific substates.

(ii) The drug changes the shape of the enzyme, and the enzyme doesn't work anymore.

(iii) The reactant is continually added.

(iv) The rate would increase because of the stomach acid.

The answer scored zero marks for parts (d) (i), (iii) and (iv). In part (d) (ii) a 1/2 mark was scored for a poor explanation of the drug binding to the active site and 1/2 mark for a poor explanation of the substrate not being able to be metabolised.

Question 34 — Control and Coordination

Most candidates answered all parts. Many candidates scored well. Answers showed a better understanding of neurone function. Some responses giving the functions for structures in part (b) and hormones in part (c) were often not specific enough with many candidates only rewording the question in (b) part (iii) and (c) part (iii).

Part (c) (i) and (ii) required candidates to name a hormone involved in feedback and the corresponding target organ respectively. Many candidates could do this, although some responded incorrectly to the term 'organ' giving tissues or cell types. Responses to part (iii) ranged from the superficial to overdetailed and confused. In part (iv) candidates needed to explain specificity in terms of specific receptors or receptor sites in target organ cell membranes and not simply 'because hormones are specific to particular organs'.

Many candidates scored poorly in part (v). Some described feedback control in terms of some other hormones. Hypothalamus function is frequently misunderstood.

The marking scheme and a range of candidate responses for Question 34 parts (c) and (g) follows.

(c)	(i)	Name of hormone.	½ mark
	(ii)	Corresponding target organ.	½ mark
	(iii)	Response of target organ.	1 mark
	(iv)	Explanation of specificity.	1 mark
	(v)	Explanation of how feedback controls the release of the hormone.	1 mark
(g)	(i)	Name of hormone and correct cellular and morphological effect.	2 mark
	(ii)	Length of darkness or daylength.	1 mark

An example of a response scoring 4 marks:

(c)	*(i)*	*TSH = Thyroid stimulating hormone.*	½ mark
	(ii)	*Thyroid gland.*	½ mark
	(iii)	*The Thyroid gland produces thyroxin.*	1 mark
	(iv)	*This hormone (TSH) only acts on the thyroid as the membranes of the thyroid cells have specific receptor sites which are only stimulated by the shape of the TSH molecules.*	1 mark
	(v)	*When thyroxin levels in the bloodstream are low, the pituitary is stimulated (via the hypothalamus) to produce more TSH. This acts on the thyroid to produce more thyroxin.* *Increased level of thyroxin in the bloodstream is defected by the pituitary (via the hypothalamus) and production of TSH is decreased leading to a decrease in the production of thyroxin.*	1 mark

An example of a response scoring 2 marks:

(c)	*(i)*	*ADH (anti diuretic hormone).*	½ mark
	(ii)	*Kidney.*	½ mark
	(iii)	*It produces more or less water in blood depending on how much ADH is present.*	1 mark
	(iv)	*Hormones are unique and affect only one specific target organ — the hormones have a specific job with a specific target organ.*	0 mark
	(v)	*The feedback system is a negative one. If the kidney produces a lot of water in the blood less is produced.*	0 mark

An example of a response scoring 0 marks:

(c)	*(i)*	*Pituitary gland hormone.*	0 mark
	(ii)	*Muscles.*	0 mark
	(iii)	*May start to spasm causing shivering.*	0 mark
	(iv)	*Specific hormones are used to control specific organs.*	0 mark
	(v)	*Feedback mechanisms keep in constant contact with the body and its needs. It is able to stimulate this hormone upon demand from the body.*	0 mark

Part (g) (i)

Most candidates were able to name at least one plant hormone and hence score one mark. However many were unsure of the effect of this hormone on the plant. Candidates needed to supply one localised or cellular effect of the hormone on the plant — for example, auxin causes cell elongation; and one morphological effect of this hormone — for example, prevent the growth of lateral buds or promote the development of lateral roots.

Part (g) (ii)

This part was done fairly poorly by candidates. Many were unaware that it is the length of the dark period which may affect plant responses such as flowering NOT 'the amount of sunlight' as many quoted.

An example of a response scoring 2 marks:

(g)	*(i)*	*Auxin — this causes cell elongation in young roots and stems. It works with other plant hormones to stimulate cell division, elongation and cell differentiation.*	$^1/_2$ mark
		Awxin also promote the growth of terminal buds.	$^1/_2$ mark
	(ii)	*The length of darkness or photo period is another stimulus for plant responses.*	1 mark

An example of a response scoring 1/2 marks:

(g)	*(i)*	*Auxin — these will bring about cell elongation in the stem causing it to grow.*	1 mark
	(ii)	*The photo periodism is a factor.*	0 mark
(g)	*(i)*	*Gibberellins cause cell elongation in stems and roots for lateral growth. They are also responsible for breaking seed dormancy.*	$^1/_2$ mark
	(ii)	*An environmental factor is the amount of water. Without enough water, plants drop their leaves.*	0 mark

An example of a response scoring 1 mark:

(g)	*(i)*	*Gibberellin/Auxin.*	1 mark
		Causes plant growth.	0 mark
		OR	
		Helps plants to grow.	0 mark
		OR	
		Assists the growth and flowering of plants	0 mark
	(ii)	*Plant responses may also be affected by the availability of water and nutrients.*	0 mark
		OR	
		The amount of sunlight is a stimulus for plant responses.	0 mark

Question 35 — Classification and the Species Concept

Parts (a) and (c)

The concept of speciation was tested in parts (a) and (c) of this question. Many candidates seemed to be familiar with the most commonly proposed means of the formation of new species, asked for in part (c), 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 (gene flow) 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 and be recognised as new species. This is referred to in most biology texts as allopatric speciation. Many candidates were not familiar with the proposed concept of sympatric speciation (examined in part a), where new forms can arise from chromosomal mutations or as the result of hybrids being produced between two species. If the offspring of these new forms are adapted to the environment, are fertile and cannot interbreed to produce fertile offspring with the original forms they are recognised as new species. Both of these processes involve polyploidy and are most common in the evolution of new plant species.

Part (b)

Many candidates still commonly failed to give features which occur in all members of a particular plant family (eg while being characteristic of the *Eucalyptus* and *Callistemon* genera, 'showy stamens' are not found in members of the genus *Leptospermum*, whereas **all** members of the Myrtaceae have inferior ovaries and aromatic oil glands (b) (ii). A number of candidates gave complex taxonomic descriptions for plant species, which were often confused and not necessarily applicable to the groups they were comparing. Obscure features (eg shapes of staminal claws) were given rather than more easily observed features, such as flower colour, leaf shape or prominent floral parts (eg straight versus hooked styles (b) (iii)). Again the study of orders, families or species from other parts of Australia, or indeed the world, seemed to have resulted in some lack of understanding of features which could be seen and understood by studying local examples during field or practical work. Some candidates again had failed to learn the **scientific names** of their plant family and species (b) (i), (iii).

The marking scheme and a range of candidate responses for Question 35 parts (b) (c) (d) (e) and (f) follow.

(b)	(i)	Correct genus and species.	½ mark
		Correct scientific family name.	½ mark
	(ii)	Two correct family features (1/2 mark each).	1 mark
	(iii)	Correct genus and species.	½ mark
		Two correct contrasting features (1 mark each).	2 marks
		OR	
		Two correct features but contrast not given (1/2 mark each).	Max 1 mark
	(iv)	If it bred with the other to produce fertile offspring;	
		OR	
		If it keyed out to the same species in a diagnostic key;	
		OR	
		If genetic/DNA testing showed it to be the same species.	½ mark

Total **5 marks**

An example of a response scoring 5 marks:

(b)	*(i)*	*Eucalyptus haemastoma belongs to the family Myrtaceae*		1 mark
	(ii)	*1. has oil glands in leaves*		½ mark
		2. has simple leaves		½ mark
	(iii)	*E. piperita*		½ mark
		E. piperita	*E. haemastoma*	
		1. conical operculum	*rounded operculum*	1 mark
		2. fibrous bark at base of tree but smooth on branches	*smooth grey bark with insect scribbles*	1 mark
	(iv)	*I would interbreed Eucalyptus haemastoma with the other plant to see if the offspring were fertile*		½ mark

Total **5 marks**

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

(b)	*(i)*	*Banksia ericifolia*	½ mark
		Proteaceae	½ mark
	(ii)	*have woody fruits*	½ mark
		flowers are in spikes	0 mark

Banksia inflorescences are in spikes but others are racemes (eg Grevilleas).

(iii) *Banksia integrifolia* ½ mark

B. integrifolia has yellow flowers and B. ericifolia red 1 mark

B. ericifolia has hooked styles ½ mark

1/2 mark only for second feature as the shape of style for B. integrifolia is not indicated

(iv) *It would need to have woody fruit, spike flower and yellow flowers* 0 mark

Description of species not enough.

Total **3 ½ marks**

An example of a response scoring 2 marks:

(b) *(i)* *Bottlebrush* 0 mark

Myrtaceae ½ mark

No mark given for common name of species.

(ii) *fruit is a gumnut* 0 mark

Not all members of the family have gumnuts.

scented leaves ½ mark

All members of the family have aromatic leaves.

(iii) *Tea tree* 0 mark

bottlebrush has long showy stamens but tea tree has short stamens 1 mark

No marks for common name but mark given for correct comparison of one feature.

(iv) *crush the leaves to see if they have a scent* 0 mark

Need to determine if they could reproduce to produce fertile offspring with each other.

Total **2 marks**

Part (d)

Responses to part (d) were generally quite good. In (d) (i) many candidates had obviously forgotten that insects belonged to the Phylum Arthropoda and/or that members of this group have an exoskeleton and jointed limbs. Many candidates scored well in (d) (iii) for listing the features of the order to which their named insect in (d) (i) belonged. Some had not committed the scientific name of the order to memory. Some candidates used the less common classification of insects belonging to the Phylum Uniramia. This and the statement of uniramian features were acceptable.

Part (e)

Some candidates had difficulty in expressing the idea that they would need to look to see if there was a gradual variation in size or other characteristics over the geographical range shown and that it could only be classed as a cline if there somehow was interbreeding of adjacent populations. Some correctly indicated that the large distances separating the rat populations made it unlikely that they were dealing with a cline rather than simply a species with a very disjunct distribution (e) (i). Many candidates did not express the fact that variation provides differences on which natural selection acts to produce change in a population in a particular environment (e) (ii). Most candidates recognised that the lack of success in interbreeding in the experiment did not necessarily indicate that they were separate species, as they may well reproduce to produce fertile offspring if they came together under natural conditions, such as after expansion of their range (e) (iii). The majority of candidates scored well in (e) (iv), indicating that *Rattus fuscipes* was most closely related to *R. rattus* as they were in the same genus.

Part (f)

Few candidates did not recognise at least one advantage of using classification (f) (i) or that structural features are less subject to change **within** a species than either distribution or behaviour (f) (iii), but a number of candidates did not explain that the hierarchical system of classification groups organisms with fewer similarities and relatedness at the upper levels of the hierarchy and those most closely related or similar at the lower levels down to species in (f) (ii).

Question 36 — The Human Species

Part (a)

Most candidates scored well in listing primate characteristics but very few described their answer which was what the question required.

Part (b)

In part (b) (i) the candidates were able to distinguish the most advanced primate and so did well here. In Part (b) (ii) when asked to explain their choice in (b) (i) the candidates became vague with their response and wrote fairly general answers.

Part (c)

Students could list characteristics which separated homo sapiens from other primates but once again found difficulty in describing their response.

Part (d)

Many candidates gave examples of changes which occurred outside the stated time period of the last 40,000 years. Some candidates gave cultural changes but did not continue with a description of the significance of the change for human societies. There were some candidates who answered in terms of genetic differences in humans.

The better answers were generally from candidates who organised their answers with a clear delineation between the two cultural changes they were discussing.

Part (e)

There appeared to be a large degree of confusion between the terms 'archaeological' and 'palaeontological'. This confusion was also evident when candidates answered part (e) (ii), as many appeared to have no idea of what other types of evidence are available.

Part (f)

Many candidates did not read the whole question before planning an answer. Consequently the answer for (f) (iii) was frequently given in (f) (ii). For (f) (i) most candidates displayed a good understanding of polymorphism although some lacked the linguistic skills to express it correctly. In (f) (ii) many candidates gave features that did **not** display a clinal gradation.

Part (g)

This section was generally well answered. When candidates are asked to give an adaptive advantaged they should state the environmental conditions under which the traits give an advantage.

Part (h)

Few candidates scored full marks in this section. In particular candidates confused genetic and medical techniques. Students in general displayed a sound understanding of how evolution could be changed but many did not relate it to human evolution.

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

Any feature relevant to a structural feature of Primates. (1 mark each) max 3 marks

An example of a response scoring 3 marks:

(a) A small insect eating mammal would have to have:

- *steroscopic vision*
- *only 2 nipples*
- *nails instead of claws.*

An example of a response scoring 2 marks:

(a) The presence of hair not fur.

- *An opposing thumb on the hand*
- *the ability to rotate the radius and ulna*

An example of a response scoring 1 mark

(a) The Primate would have:

- *opposable thumb*
- *upright stance*
- *hair or fur.*

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

(i) Naming the most advanced primate jaw. 1 mark

(ii) Any two reasons (descriptive) supporting their response (i). 2 marks

An example of a response scoring 3 marks:

(i) *The most advanced primate is Jaw B.* 1 mark

(ii) *Two reasons which support Jaw B is that the dentition is of a parabolic (V) shape and that the teeth in Jaw B are smaller and more uniform in size.* 2 marks

An example of a response scoring 2 marks:

(i) *Jaw B.* 1 mark

(ii) *The jaw is smaller and the teeth are unspecialised.* 1 mark

An example of a response scoring 1 mark

(i) *B* 1 mark

(ii) • *More narrow teeth.*

• *Smallest of all jaws.* 0 mark

Question 37 — Genes in Action

A detailed understanding was required for full descriptions of: the role of messenger RNA and transfer RNA in protein synthesis; the consequences of a frameshift mutation; the effects of mutations on gene expression and non-disjunction. Part (a) (iii) was poorly answered by the majority of candidates. Not many candidates in (a) (iv) knew a correct chemical substance which promotes gene mutation even when several are mentioned in the syllabus.

Genetic punnet squares were satisfactorily done, but some candidates did not distinguish between genotype and phenotype. In the ABO blood system, many candidates did not know that the blood group is the phenotype, and that it is **not** the blood broups but the **genes** that are dominant, recessive or co-dominant.

The dangers and ethical problems that cloning may present in the future were very general. Many candidates did not specify whether their answers were dangers or ethical problems.

Protein synthesis, and the roles of messenger RNA and transfer RNA were not explained well.

The marking scheme and a range of candidate responses for Question 37 parts (b) and (c) follows.

(b) (i) Describe one way that changes in chromosome might occur. 1 mark

(ii) An effect of a change in chromosome number on sexually reproducing organism. 1 mark

(c) (i) Name/state the type of inheritance pattern. 1 mark

(ii) Explain how it produces a range of heights. 2 marks

An example of a response scoring 2 marks:

(b) (i) Non-disjunction of chromosomes may cause chromosome numbers to change. This occurs when homologous chromosomes fail to separate during the first division of meiosis, creating gametes with 2 chromosomes (instead of just one) of that pair. 1 mark

(b) (ii) Downs Syndrome results in a diploid number of 47 chromosomes in every cell. 1 mark

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

(b) (i) Non-disjunction. ½ mark

(ii) The reproductive ability of a sexually reproducing organism is lowered — it may even be sterile. 1 mark

An example of a response scoring 2 marks:

(c) (i) Polygenic inheritance. 1 mark

(ii) The characteristic of height is controlled by many genes. 1 mark

An example of a response scoring 3 marks:

(c) (i) Polygenic inheritance. 1 mark

(ii) The characteristic of height is controlled by more than one pair of genes. This results in continuous inheritance, forming a gradual series or continuous variation in the heights of individuals in a population. 2 marks

Question 38 — Human Environmental Impact

Candidates tended to give general answers which lacked the concepts and language of biology. Too few candidates were able to provide the specific information needed to adequately and succinctly respond to the question. Students need to recognise and interpret the key words and directions in each question. Many candidates did not address the question which was asked. For example, in part (e), candidates could name an introduced species and describe its impact, but frequently could not explain why the impact had been so dramatic.

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

(f) (i) Detailed description of biomagnification through the food chain of the pelican. 2 marks

(ii) Lowers the population. ½ mark

Greater number of egg breakages. ½ mark

(iii) DDT not metabolised in the pelican

OR

DDT not broken down in the environment. 1 mark

An example of a response scoring 4 marks:

(f) (i) DDT is washed off farming land into waterways. Algae absorb the DDT and then fish eat the algae. The pelican is further up the food chain, and takes in DDT when eating fish. As the pelican eats a large number of fish in its lifetime, it consumes a relatively large amount of DDT, which it accumulates. This is called biomagnification.

(ii) The pelican population could decrease because of the greater chance of the eggs breaking.

(iii) The DDT is not broken down in the environment, so it is still being passed along the food chain to the pelican.

An example of a response scoring 3 marks:

(f) (i) DDT makes its way into waterways after it has been sprayed onto crops. The algae in the water come into contact with the DDT and take it in. The fish then eat the algae, therefore when the pelicans eat the fish, the DDT accumulates in their bodies also.

(ii) Thin shelled eggs are more susceptible to breaking and fewer chicks will hatch.

(iii) DDT is non-biodegradable and stays in the environment for a long time.

In part (f) (i), the candidate scored 1 1/2 marks for the description of the pelican's food chain. In part (f) (ii) 1/2 mark was awarded for explaining why the population of pelicans changes, and 1 mark in part (f) (iii) for explaining why the DDT level is still high in the pelican.

An example of a response scoring 2 marks:

(f) (i) DDT runs into streams where it is absorbed by the fish. The pelicans eat the fish and take in DDT at the same time.

(ii) The pelican population goes down.

(iii) DDT is not broken down in the body of the pelican.

In part (f) (i), the candidate scored 1/2 mark for the food chain description. In part (f) (ii) 1/2 mark was awarded for indicating that the population would decrease, and in part (f) (iii) the candidate scored 1 mark for stating that the pelican cannot easily break down the DDT in its body.