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1998 HSC

EXAMINATION REPORT

Biology

Including:

- Marking criteria
- Sample responses
- Examiners' comments

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BIOLOGY

In 1998 a total of 14766 candidates sat for the HSC Biology examination, this was an increase from 1997.

General comments

In general, the standard of the candidates' responses was pleasing and consistent with recent years. There is evidence that a large number of candidates were not adequately prepared for the examination. Many of these had a poor understanding of course content. Of particular concern was the large number of candidates with only a general understanding of the concept of biological evolution. These candidates gave confused responses which lacked adequate specificity and detail.

As in previous years, a number of candidates showed only limited understanding of biological terminology and were confused in their use of the language of biology. Students must understand key words in a question and be able to answer questions that ask them to indicate, describe, distinguish, discuss or explain, for example. Many candidates simply restated the stimulus material as their answer to the question. Some 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 using appropriate and recognisable biological terms.

Samples of some of the marking schemes are provided in this document, 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 teachers and 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 produced under examination conditions, and therefore they may contain misspellings and other errors.

SECTION I – CORE

PART A

The candidates were generally able to score well across the multiple-choice questions. A few of the questions in this part of the paper were challenging for the less prepared candidates or those with a limited understanding of biological terminology and concepts.

The following table gives the percentage of candidates selecting each alternative for the multiple-choice questions. The alternative that best answers the question is marked with an asterisk.

Question	A	B	C	D
1	87.43*	1.87	3.84	6.72
2	7.94	24.07	41.62*	26.05
3	85.43*	2.92	2.42	9.02
4	6.48	3.83	81.80*	7.70
5	20.37	14.49	6.30	58.50*
6	0.97	13.41	7.00	78.42*
7	6.15	82.13*	8.65	2.90
8	82.07*	5.31	5.37	6.89
9	3.88	48.20	13.09	34.38*
10	10.01	13.40	73.72*	2.52
11	7.94	4.19	86.97*	0.59
12	2.21	86.57*	10.56	0.43
13	93.28*	2.54	2.41	1.56
14	2.36	49.00*	37.76	10.58
15	8.25	4.04	16.64	70.86*

SECTION I — PART B

Question 16 – 25

Question 16

In part (a) many candidates correctly identified the type of cell division as meiosis, but many also incorrectly called it 'crossing over', or failed to name any type of cell division. The majority of candidates who correctly answered part (a) went on to give the four correct genotypes in the daughter cells, but others listed only two possible gene combinations each with four genes. Part (c) was generally well answered, with most candidates explaining that crossing over increases variation in gametes.

The marking scheme and a range of candidate responses for Question 16 follow:

Marking scheme

(a) Meiosis	1 mark
(b) AB, Ab, aB, ab	1 mark
Two or three of the above correct	1/2 mark
(c) Increased variation	1 mark
Variation	1/2 mark

Example of a response scoring 3 marks

(a)	Meiosis	1 mark
(b)	Ab, Ab, aB, Ab	1 mark
(c)	Increases variation which increases	1 mark
	the species' chance of survival	3 marks

Example of a response scoring 2 marks

(a)	Meiosis	1 mark
(b)	Ab, Ab, aB, aB	1/2 mark
(c)	Causes variation in gametes	1/2 mark
		2 marks

OR

(a)	Mitosis	0 mark
(b)	AB, Ab, aB, ab	1 mark
(c)	Provides increased variation	1 mark
		2 marks

Example of a response scoring 1 mark

(a)	Crossing over	0 mark
(b)	Aa, AB, Bb, ab	1/2 mark
(c)	Variation	1/2 mark
		1 mark

Question 17

This question was quite well answered with most candidates having a good knowledge of how the body is protected from harmful bacteria in each section. Better candidates were able to detail characteristics of the skin which make it an effective barrier in part (a), and indicate that strong levels of acid in the stomach destroy bacteria in part (b). In part (c) most candidates identified that cilia expel the bacteria; the better candidates were able to detail how this occurs.

Question 18

(a) Candidates experienced difficulty explaining the maintenance of turgor at a cellular level. Some candidates mentioned the process of osmosis or diffusion of water but few explained the process. Many candidates were able to clearly express the idea that turgor was related to the presence of water inside the cell.

(b) Most candidates demonstrated a good understanding of structural adaptations in plants for obtaining water, with some candidates quoting physiological or behavioural adaptations. Some candidates mentioned the use of structural adaptations which were not used for obtaining water from soil.

(c) Most candidates showed a good understanding of physiological or behavioural adaptations in desert plants but some quoted structural adaptations in their answers.

Question 19

(a) The majority of candidates were able to state the term carrier as the correct answer.

(b) Candidates used a range of diagrams/pedigrees/family trees to answer this question. Many candidates used conventional symbols but made errors when designing the key to explain the diagram. Some candidates used autosomal crosses rather than correct conventional sex linkage. Candidates also used unorthodox diagrams with labels, keys and explanations to correctly answer the question.

The marking scheme and a range of candidate responses for Question 19 follow:

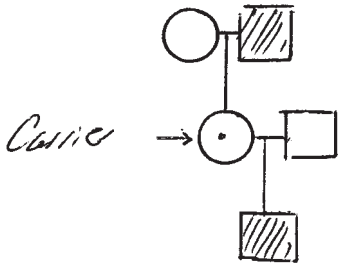
Marking scheme

(a)	Carrier	1 mark
(b)	A diagram which indicated:	
	A haemophiliac grandfather with an unaffected partner/carrier	1/2 mark
	A carrier daughter from this cross with an unaffected partner	1 mark
	A haemophiliac son from the above cross	1/2 mark

An example of a response scoring 3 marks

(a) Carrier — 1 mark

(b) — 1/2 mark



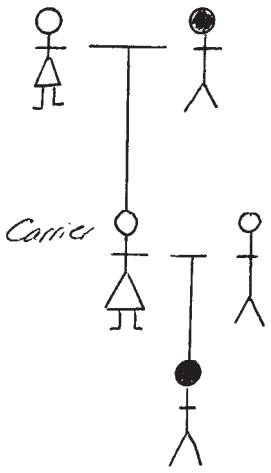
2 marks

1/2 mark

This response scored full marks because a conventional pedigree was drawn using correct symbols and the carrier daughter was clearly indicated.

An example of a response scoring 2 marks

(a) Heterozygous recessive haemophiliac — 0 marks



Key:

Haemophiliac male — 1/2 mark

Unaffected female — 1 mark

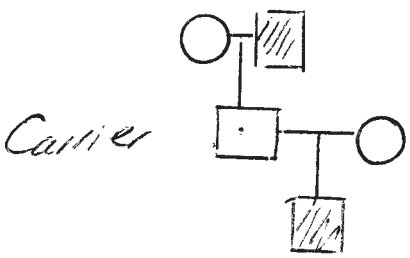
Unaffected male — 1/2 mark

Even though unconventional symbols are used the candidate has a key and labels to clearly identify each member in the family tree.

An example of a response scoring 1 mark

(a) Heterozygous normal — 0 marks

(b) — 1/2 mark



0 marks

1/2 mark

The candidate has correctly identified the affected grandfather and grandson using conventional symbols but incorrectly identified the father as being the carrier.

Question 20

This question was generally well answered.

A majority of candidates understood the process by which Koch's postulates could be used to identify bacteria or the cause of death of oysters living in sewage-contaminated water.

The best answers given by students were presented in a series of steps detailing each part of Koch's postulates. Appropriate use of the terms 'isolation', 'culture' and 'inoculation' were characteristic of very good responses.

Candidates who lost marks usually did so for answers which did not clearly outline the steps involved in Koch's postulates or for using terms such as 'infection' or 'organism' out of context. Many candidates did not state that the bacteria must be present in all cases of the disease. Most candidates stated that a comparison needed to be made between the bacteria isolated from the diseased host and those isolated from the experimental host. However, many of these students failed to state that the bacteria must be identified as the same in both the diseased host and the experimental host to determine that it was the cause of the disease in question.

Question 21

A large proportion of the candidates had difficulty with this question, particularly part (a).

In part (a), a majority of the candidates were unable to relate the function of the protein, histone, to its amino acid sequence. Many students either rewrote the question or made no attempt.

In part (b), a large number of candidates did recognise that Darwin's theory could explain the similarity of histones by plants and whales having a common ancestor. However, many students only gave one point and had difficulty writing an answer in the limited space available (three lines).

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

Marking Scheme

(a) The amino acid sequence determines the function of proteins 1 mark

OR

The function of proteins is determined by/as a consequence of the amino acid sequence

(b) Any two of: 1+1 = 2 marks

- the plant and whale have a common ancestor
- the histone structure is a successful adaptation
- the selecting agents have not changed and there is no pressure for histone structure to change
- the histone structure/amino acid sequence is passed on to the organisms offspring.

Total 3 marks

An example of a response scoring 3 marks

(a) The sequence of amino acids is what 'codes' the function of the protein

(b) This histone has ensured the survival of species containing it, plants and whales may have evolved from a common ancestor. Slight change has occurred in histones as natural selection has ensured they are better adapted to their environment.

Part (a) scored 1 mark for explaining that protein function depends upon (is 'coded' for) amino acid sequence.

Part (b) scores 1 mark for common ancestor and 1 mark for that histones in plants and animals are a 'better adaptation', ie successful adaptation.

An example of a response scoring 2 marks

(a) Amino acids help the production of protein

(b) There was a plant in evolution where this adaptation was vital and organism containing it survived and passed on the characteristics.

Part (a) scores 0 marks as the student has not related protein structure to function but discussed protein synthesis.

Part (b) scores 1 mark for 'vital', (successful) adaptation and 1 mark for stating it is passed on.

An example of a response scoring 1 mark

(a) Histones are a vital part of D.N.A. replication and are found in many organisms.

(b) They are similar because they are both well adapted to their environment.

Part (a) scores 0 marks as it is simply the question re-written.

Part (b) scores 1 mark for stating that they (histones) are well adapted.

Question 22

Candidates scored well in this question when they related the features of the pathogens and/or host to the infection of a large number of people, ie an epidemic. A number of candidates answered by recalling knowledge of a pathogen and its transmission and effect on the host, without reference to features that were likely to cause an epidemic.

In part (a), describing a 'feature' was generally answered well. In part (b) some candidates failed to score marks because the reason did not refer to epidemics. Others were confused about or misunderstood that the question required a reason why each feature made an epidemic likely and simply again described a feature of the pathogen or host.

Question 23

This question presented no particular problems for the majority of candidates. Most were able to answer part (a) with reference to moist surfaces required for diffusion of gases across the respiratory surface. A number of candidates referred to the need for protection, without giving any detail, and did not score marks for this. (Protection from pathogens or infection was required.) In part (b) the majority of candidates correctly stated attributes of the respiratory surface such as

large surface area, thin membrane or well-vascularised. Few candidates wrote of features that enhanced ventilation (eg contraction of diaphragm for inhalation) but those that did usually scored well.

Question 24 – Abiotic Characteristics

Many candidates were able to correctly name three abiotic characteristics, eg light availability, pressure, temperature variation. A very small number named biotic characteristics while a surprisingly large number of candidates did not attempt this question or were unable to name three abiotic characteristics.

Explaining the difference between a deep lake and a desert environment:

Candidates who named three characteristics were adequately able to compare them in the two environments, eg:

Abiotic Characteristics	Deep Ocean	Desert
Light Availability	Decreases with depth	Freely available
Pressure	Increase with depth	Decreases with altitude
Temperature	Decreases with depth	Large variations

Some candidates gave inadequate explanations of differences. Using arrows to indicate high and low without comment was unacceptable. Other minimal comparisons were also not accepted, eg:

Abiotic Characteristics	Deep Ocean	Desert
light availability	Low	high

Question 25

Using terms correctly was the key to gaining good marks in this question. The use of Lamarckian language was not accepted.

(a) Candidates who were able to show they knew that simple organisms were well adapted to their environment and that their environment had remained relatively constant gained full marks. Full marks were also awarded if candidates stated that simple organisms were able to adapt over time to produce many variations suited to a wide range of environments.

(b) In general, candidates understood that sharks were well adapted to their environment and that the environment had remained relatively unchanged.

(c) The candidates in general understood that dinosaurs did not adapt to changes in the environment and so did not survive as a species. Some students did not choose their language carefully and made statements such as ‘the highly evolved animals could not ‘cope’ or ‘they needed to change’.

SECTION I — PART C

Questions 26 – 31

Question 26

(a) Generally well answered. However, many candidates wrote sentence answers rather than listing two physical features. A minority of candidates misinterpreted the phrase 'physical features of the environment' and gave physical features of the jerboa.

(b) Most candidates correctly identified the adaptations as structural, physiological or behavioural. However, in (b) parts (i), (ii) and (iii) candidates failed to 'detail how' the adaptation enabled the jerboa to survive in a hot dry environment. (b) (iii) was poorly answered as candidates were unable to 'detail how' a short pregnancy could take advantage of favourable food/water supplies in a hot, dry environment.

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

Marking scheme

(a) PHYSICAL FEATURES

- First example of physical feature 1/2 mark
- Second example of physical feature 1/2 mark

(b) ADAPTATIONS

(i) Behavioural 1/2 mark

How the adaptation may assist survival 1/2 mark

(ii) Structural 1/2 mark

How the adaptation may assist survival 1/2 mark

(iii) Physiological 1/2 mark

How the adaptation may assist survival 1/2 mark

(iv) Physiological 1/2 mark

How the adaptation may assist survival 1/2 mark

An example of a response scoring 5 marks

(a) Low water availability

High temperatures

(b) (i) Behavioural. By feeding at night, the mouse will be most active when the temperature is lower. This assists survival by minimising water loss which would occur in the hot day.

(ii) Structural. Large ears increase SA:V ratio of the mouse and can increase heat loss.

(iii) Physiological. Short pregnancy means during times of good rain, reproduction can occur fast to take advantage of this ie. Better conditions for offspring to survive as more food and water. (normally dry)

(iv) Physiological. Producing concentrated urine ensures minimum water loss in an environment where water is scarce.

The answer listed correct physical features, stated correct adaptations and detailed how they assisted survival in the environment.

An example of a response scoring 4 marks

(a) low water availability

hot day time temperatures

(b) (i) Behavioural avoids heat of the day and in desert environment there's more food out at night.

(ii) Structural increases SA:V ratio and therefore increases heat loss.

(iii) Physiological takes stress away from mother eg. Doesn't have to eat/drink for two for as long.

(iv) Physiological kidneys reabsorb as much water as possible reducing water loss which is helpful because of the low water availability.

Parts (b)(i) and (iii) did not detail how the adaptation assisted survival and could not be awarded full marks.

An example of a response scoring 3 marks

(a) Hot, dry climate/environment (desert)

(b) (i) Behavioural Nocturnal feeding allows the jerboa hopping mouse to eat in a cooler climate for regular temp. and metabolism.

(ii) Structural Large ears give the jerboa hopping mouse a larger SA:V ratio to increase water gain.

(iii) Physiological Short pregnancy so the mother doesn't have to carry the weight around too much in hot conditions.

(iv) Physiological Concentrated urine allows for the mouse to hold more water in.

No responses in part (b) detailed how the adaptation assisted survival and could not be awarded full marks.

An example of a response scoring 2 marks

(a) Hide so that it doesn't get eaten

Quick reproduction period

(b) (i) Behavioural – as it won't hurt the babys eyes

(ii) Structural – to hear noises from a long way

(iii) Physiological – so mothers not lying around

(iv) Physiological – as it leaves a high scent so other mice can find them.

In part (a), physical features of the environment were not listed so no marks awarded. In part (b) correct types of adaptation were identified, but no correct detail of how the adaptation assisted survival were provided.

An example of a response scoring one mark

(a) No trees like a desert, its predators.

(b) (i) Nocturnal feeding is a physiological adaptation. It helps its young by feeding

(ii) Large ears is a structural adaptation. It helps the mouse to cool down in hot and warm up in cold temperature.

(iii) Short pregnancy is a behaviourable adaptation – it allows the mouse to relieved sooner.

(iv) Concentrated urine is a physiological adaptation and I don't know why.

No marks could be awarded to part (a) since no correct physical feature of the environment was provided. In part (b) only two correct adaptations were indicated and no correct details were provided.

Question 27

Part (a) was answered correctly by the majority of candidates.

Many candidates answered part (b) correctly, but some failed to explain that, in order to test for a pure breeding characteristic, the plant being examined needs to be crossed with a plant with a plant with the recessive phenotype. Many candidates failed to use the correct terminology.

In part (c) most candidates described the correct genotype. Many failed to explain accurately that for the recessive characteristics to be expressed in the phenotype, the genotype needs to be homozygous.

Some candidates did not indicate parental genotype in their working in part (d). Calculations were generally correct and students indicated a ratio consistent with their workings.

Most candidates answered part (e) incorrectly, often relating the result to a ratio of 3:1 or 9:3:3:1. Some candidates did not understand that a result of 102:98 confirms a 1:1 ratio.

Question 28

This question revealed that many candidates had a poor understanding of the theory of evolution. A significant number did not attempt parts of the question.

In (a) candidates had difficulty justifying their answer with specific examples. Poorly prepared candidates gave general information which did not answer the question.

In (b) (i) some candidates described how to date the earth or wrote about the 'earth evolving', rather than explaining how the age of the earth provided evidence to support the theory of evolution.

Parts (b) (ii) and (iii) were well answered by the better prepared students.

Question 29

The responses to this question showed that most candidates were well-prepared with a good specific understanding of the subject and the mechanisms involved in the immune response. There were very few non-attempts.

In part (a) some did not give a clear reason for the acquired immunity, but were able to discuss well the cellular mechanisms involved.

In part (b), although generally well answered, some candidates lost marks through lack of detail in their answers.

In part (c) there was a wide range of responses, although most candidates understood the harm of injecting pathogens.

In part (d) the processes of active and passive immunity were well understood and these answers were of a high standard.

The marking scheme and a range of candidate responses for Question 29 follow:

Marking Scheme

(a) 2 marks total

Must have a clearly stated reason 1/2 mark

Mechanism:

- First exposure produces either memory cells or antibodies 1/2 mark

AND

- On re-exposure memory cells recognise antigen/pathogen

AND 1/2 mark

- Produce antibodies in larger amounts and/or destroy the pathogen more quickly the second time 1/2 mark

(b) 1 mark total

- Must elaborate on specificity of immune response to a particular pathogen 1 mark

OR

- Comparison of the response to the two pathogens 1 mark

OR

- Mention of immunity to the first/second pathogen without linking the two 1/2 mark

OR

- Genetic resistance explained 1 mark

OR

- Genetic resistance not explained 1/2 mark

(c) 1 mark total

- Would harm/kill some individuals, which is not the aim of immunisation (ie elaborate on answer) to explain why it is not a good idea 1 mark

OR

- Would make people sick/kill some people/cause an epidemic (spread disease) 1 mark

(one of these) 1/2 mark

OR

- It may be responsible for creating an epidemic, not preventing it (elaborate) 1 mark

OR

- It would cause epidemic/spread disease (no elaboration) 1/2 mark

(d) 1 mark total

- Vaccination with attenuated and/or less dangerous strain of pathogen to stimulate immune response/or without endangering life 1 mark

OR

- Vaccination with attenuated/less dangerous strain 1/2 mark

OR

- Passive immunity and its effectiveness — elaborate 1 mark

OR

- Passive immunity — injecting antibodies — no elaboration 1/2 mark

TOTAL 5 marks

An example of a response scoring 5 marks

(a) Because person Y would have acquired natural immunity to the bacteria. The B-cells are white blood cells responsible for antibody mediated immunity within the human immune system. Memory cells 'remember' the specific antibody code needed to neutralise an antigen (in this case a bacteria) therefore reinfection is prevented as any bacteria trying to reinfect is neutralised before body is affected.

(b) Person 2 may have possessed a natural resistance to the bacteria or may have acquired immunity previously meaning 2 was not sick. However, antibodies are very specific to the antigen they are effective against, so 2 may not be able to fend off infection by different bacteria. Specific antibodies needed for each antigen.

(c) Because X actually died, so in some individuals, pathogen is deadly — rather than simply stimulating an immune response, it may kill, so some members of community would not acquired immunity – would die.

(d) It would be safer to immunise with an attenuated (weakened) strain of the bacteria which stimulated the appropriate antibody response without killing anyone.

In part (a) a good reason is given and mechanisms were fully explained. Parts (b), (c) and (d) contained good, clear explanation and were awarded full marks.

An example of a response scoring 4 marks

(a) If person Y was re-exposed to the same bacteria the B and T memory cells made and stored from the initial dose or exposure would be activated causing plasma cells to produce a faster higher dose of antibodies to destroy the bacteria before symptoms would appear.

(b) Person 2 may not have been previously exposed to a different bacteria and because antibodies are specific to only one pathogen, the person may get sick before plasma cells are able to make a new antibody specific to this bacteria.

(c) If these people have not been previously exposed to this bacteria or pathogen, they may die like person X before enough antibodies are produced to overcome the disease.

(d) Immunise the population by injecting a weakened or dead or attenuated version of the pathogen or toxin so it stimulates antibody production but the pathogen does not cause the disease.

In part (a) no mark is given for the reason, but mechanisms earned full marks. In part (c) no clear explanation given but a mention of some 'may die' scored 1/2 mark.

Parts (b) and (d) were well answered and scored full marks.

An example of a response scoring 3 marks

(a) Person Y would have built up specific antibodies in fighting the bacteria. If reinfected, these would be all ready to fight the bacteria. This acquired immunity allows protection against that specific strand of bacteria. (1 mark)

(b) Person Z might not have the required immunity levels to fight off a different bacteria as the antibodies might not be specific to the bacteria. (1 mark)

(c) The bacteria could spread wildly and some people wouldn't be able to fight off the infection. The whole community could become sick and it could cause an epidemic. (1 mark)

(d) Vaccinations against bacteria for the community would help eradicate the disease. (0 marks)

In Part (a) the reason was acceptable but the mechanism was lacking. Part (b) gives a clear indication of specific immunity. In part (c) spreading disease and causing sickness were acceptable. There was no explanation of how to vaccinate the community in part (d).

An example of a response scoring 2 marks

(a) The reason why Y took less time to recover is because he/she was exposed to the pathogen before so there was some immunity to the pathogen. It took five days to fight a familiar pathogen. (1/2 mark)

(b) Person 2 was immune to that bacteria but he/she is not immune to all pathogens, so if exposed to another pathogen he might get sick. (1 mark)

(c) If you inject only a few then only a few would have immunity or partial immunity. The rest of the community would still be effected because they were not exposed to the pathogen before. (0 marks)

(d) A better way of immunising the population would be to inject everyone with a weakened dosage of the pathogen so they all would be immune to it. (1/2 mark)

In part (a) the reason was acceptable but no mechanisms were explained. Part (b) gives a clear indication of specificity. In part (c) the question is misinterpreted and part (d) is not specific enough.

An example of a response scoring 1 mark

(a) The body of person Y has the cytosis to destroy the pathogen by the time to take the process.
(0 marks)

(b) It is because person Z only has immunity to that pathogenic bacteria but not for the other bacteria.
(1 mark)

(c) The injection of these pathogens will protect the immune system by immunising the community that are effected by it. (0 marks)

(d) Isolated all the infected people. Then inject a particular vaccine into the infected person. Burn all the infected clothes. (0 marks)

Part (a) did not score because no clear reason was given and no mechanism was described. Part (b) scored a full mark because it compared the immunities to the two pathogens clearly. Part (c) does not answer the question and in part (d) isolation is not a method of immunisation. Neither parts score any marks.

Question 30

Part (a) Many candidates recognised the importance of sweating but most had difficulty in suggesting a second valid mechanism.

Part (b) The better candidates argued that the lizard was ectothermic and would not survive in the oven because behavioural adaptations used in desert conditions would not be available to it.

Part (c) Most candidates failed to recognise the importance of the words 'on humid days'. Some compared the length of exposure on humid days with 20 minutes in the oven. Others suggested that humid conditions would lead to decreased availability of oxygen or would cause dehydration.

Part (d) The majority of candidates discussed the effect of body temperature variation in a very general way but some recognised the significance of body temperature for enzyme action.

Marking Scheme

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

(a) 2 marks maximum

- sweating to cause 1/2 mark
  - evaporation 1/2 mark
  - cooling 1/2 mark
- any suitable explanation of this mechanism 1/2 mark

(b) 1 mark maximum

For 'No'

- ectotherm/cold blooded/poikilothermy 1/2 mark
- body temperature 'follows' outside/body temperature will rise 1/2 mark
- behavioural adaptation not available/ineffective 1/2 mark
- any appropriate physiological mechanism 1/2 mark

OR 'Yes'

- with a good lizard adaptation to the same condition — 1/2 mark per adaptation
- explanation of the adaptation — 1/2 mark

(c) 1 mark maximum

- correct indication of humidity as a factor — 1/2 mark
- indication that conditions lead to reduced sweating — 1/2 mark
- sweating is ineffective — 1/2 mark
- indication that the conditions lead to reduced cooling — 1/2 mark

(d) 1 mark maximum

- disruption to general body functions — 1/2 mark
- enzymes/catalysts/proteins — 1/2 mark
- extended explanation of enzymes — 1/2 mark

An example of a response scoring 5 marks

(a) sweat glands would be operating so that the men's bodies could be cooled by the sweat evaporating from their skin. blood vessels in close contact with the external environment eg hands, face would dilate allowing greater blood flow and greater heat loss by conduction.

(b) no, lizards are ectothermic, meaning that their body temperatures are controlled by the external environment. The lizard's temperature would rise beyond the point where cellular chemical reactions could occur, enzymes would be destroyed, and the lizard would die.

(c) When the air is humid water cannot be evaporated from the skin to effectively lower body temperatures. Therefore people would not be able to control their body temperature in this way.

(d) A constant body temperature is important so the body can function normally. Enzymes which catalyse cellular chemical reactions only function in a certain temperature range. When temperatures are too high or too low they cannot function and so vital processes (eg respiration) will stop and organisms will die.

In each part the candidate has correctly addressed the question.

An example of an answer scoring 4 marks

(a) They are endothermic – produce their own body heat. Blood vessels could have dilated to allow heat to escape. Sweat would have been evaporated to cool them down. Heat would have been conducted through them to the ground and would have radiated through cloting. Humans also possess much water in their body and so after 20 mins, would not have dehydrated.

(b) No, a lizard is ectothermic – its body temperature is controlled by the surrounding temperature. To cool down, the lizard would have had to escape to the shade or other cool environment. The lizard's body would have overheated and it would die from heat exhaustion.

(c) They are exposed to that temperature for a much longer period of time. They may have insufficient water, which would lead to dehydration and add to the heat exhaustion that would kill them.

(d) Enzymes work best at a certain body temperature (for humans 37.6˚C). If this body temperature is higher or lower than usual these enzymes won't function efficiently. A constant body temperature is important for enzyme function.

Parts (a), (b) and (d) satisfactorily answer the question, but in part (c) the significance of humidity is overlooked, and scores a zero.

An example of an answer scoring 3 marks

(a) Due to the ability of mammals to maintain a constant body temperature, it would take longer for the affect of the increased heat to have an effect on the body.

(b) No, a lizard would not be able to survive as it is ectothermic relies on outside heat to warm and cool its body. When placed inside the oven it would have been too hot.

(c) When it is humid, mechanisms of the body to cool down do not work as well. Peoples sweat is not able to evaporate as well, because the air is already dense with water. Therefore it is possible to die in 45˚C heat.

(d) It is important to maintain a constant body temperature to keep the vital organs operating. Because of this we are able to survive in hot and cold situations.

The discussion in part (a) is weak and receives only 1/2 mark. Parts (b) and (c) are correctly addressed but the answer to (d) is very general and scores 1/2 mark.

An example of an answer scoring 2 marks

(a) Humans are endothermic they are able to regulate their internal body temperature regardless of the outside air temp. The air was dry thus not really encouraging sweating thus conserving energy as well as water.

(b) A lizard would have not been able to survive in these same conditions due to the fact they are ectothermic (can't regulate their body temp) it changes with the outside air temp thus causing death due to extreme temp.

(c) On humid days we tend to sweat as there is no moisture in the air thus we dehydrate and our bodies cannot cope with the severe water loss.

(d) It is important to maintain a constant body temperature so that our bodies can function normally and effectively. If our internal body temperature rises then it can cause permanent damage to our internal organs eg brain damage.

Parts (a) and (d) have weak answers and score a 1/2 mark each. Part (b) is adequate. Part (c) fails to recognise the significance of humidity and scores zero.

An example of an answer scoring 1 mark

(a) The men have a constant body temp which didn't change even when the temp 127˚C also they would have been sweeting which control the heat gain.

(b) No, as the lizard body temp change with the environment, so the lizard would of got cooked like the steak.

(c) Their bodies are not working properlly, which made the not able to change with the environment quicker enough.

(d) So all the metabolism with in the body all stay the same and work right.

Parts (a) and (b) are weak and score 1/2 a mark each. Part (c) and (d) are too general, so no marks are awarded.

Question 31

Most candidates recognised that this question was linked to Core 9 Human Disease in the Syllabus.

Many candidates in part (a) failed to adequately differentiate between a parasite and commensalism. In part (b), scientific terminology was rarely used in naming the parasite and/or failed to relate the parasite to human disease. Descriptions of adaptations for the named parasite in part (c) were often poor or superficial. Better answers in part (d) included two different categories of effect and how they were produced. Effects in species other than humans or primary hosts were not accepted as this core topic requires an understanding of parasites causing disease in humans.

SECTION II — ELECTIVES

Question 32 – 38

Question 32 — The Australian Environment

The question was generally well answered by most candidates and the standard of Biology was sound. The candidates responded in detail to all sections and indicated an awareness of the mark value of each section.

In part (a) (i) and (ii) the majority of candidates could correctly name a member of the Myrtaceae or Proteaceae family and gave accurate descriptions of how human activity, topography and climate affected its present distribution. In (a) (iii) candidates showed good knowledge of Continental Drift, Gondwana and the climate changes involved since the continents separated. Some candidates had difficulty relating the changes in climate to the changes in some plant distributions.

Candidates showed sound knowledge of food webs in (b) (ii), with a few forgetting to label the introduced and indigenous animals. Life cycles were generally well constructed although some candidates need to take more care with the processes such as meiosis, mitosis and fertilisation.

In part (c) the majority of candidates had little trouble with determining the abundance of an organism and explaining advantages and disadvantages of the method. Candidates did have difficulty in determining the distribution of an animal. Many chose an inappropriate method for the animal nominated. Some candidates did not name an animal.

The majority of candidates answered part (d) well. Some candidates responses would be improved by using ecological terms, eg predation, breeding programs, competition, resources, population changes.

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

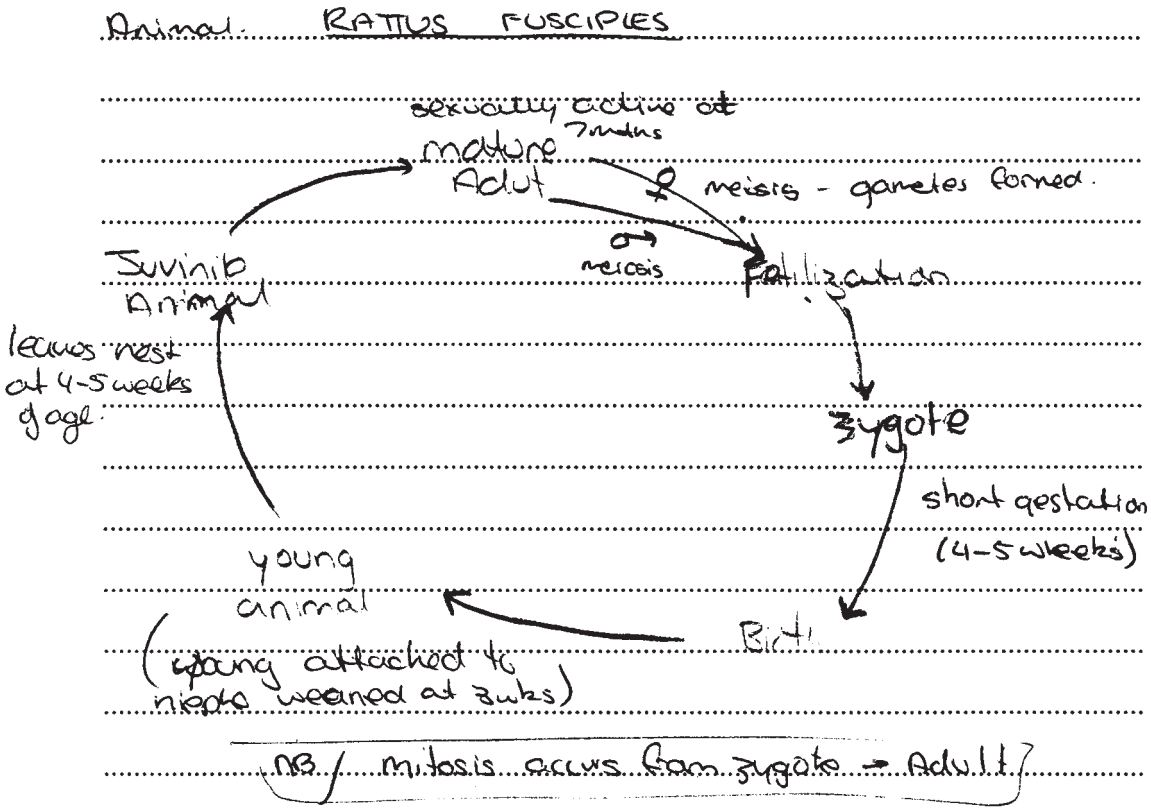
Marking Scheme

(b) (iii) Animal Life cycle

- 3 correct stages listed 1/2 mark
- 2 processes mentioned 1/2 mark
- a cycle indicated 1/2 mark
- its impact on the area dynamics 1/2 mark

Note: The same marking scheme applies for the Plant Life Cycle.

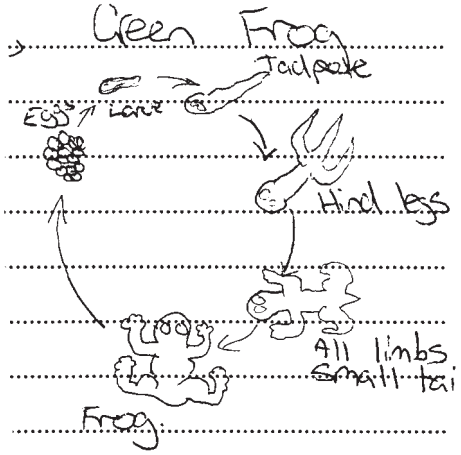
An example of a response scoring 2 marks



Impact on area Dynamics: The food it eats include berries. The seeds of these berries are eaten and passed out in faeces. The nutrients from the faeces help the new seed to grow.

The candidate gained 1/2 mark for 3 correct stages, 1/2 mark for 2 processes (fertilisation, meiosis,) 1/2 mark for a cycle and 1/2 mark for its impact.

An example of a response scoring 1 mark



The candidate scored a 1/2 mark for three correct stages and a 1/2 mark for indication of a cycle. No marks were awarded for processes or impact on the area dynamics.

An example of a response scoring 1/2 mark

3. Life cycle of a Koala. Eats, sleeps, reproduces. Needs eucalyptus trees to survive as it sleeps in the fork of these trees and only eats these trees.

The candidate gained a 1/2 mark for the koala's impact on eating eucalyptus trees.

The marking scheme and a range of responses for Question 32 part (c) (i) and (ii) follows:

Marking scheme

(c) (i) Measuring Distribution

- name of method 1/2 mark
- outline of method 1/2 mark
- advantage of the method 1/2 mark
- disadvantage of the method 1/2 mark

Note: The marking scheme for measuring abundance is the same.

An example of a response scoring 4 marks

Animal: European rabbit

(c) (i) Distribution can be done by setting traps for the rabbits and then recording the range from where the rabbits were trapped on a map.

Abundance can be determined by the capture/tag/release method. A sample of rabbits is caught and tagged and then released into its habitat. A 2nd sample is caught and the numbers with tags counted. The following formula is applied to estimate the total population.

$$\text{Rabbit Population} = \text{No. rabbits originally tagged} \times \frac{\text{No. rabbits in second sample}}{\text{No. tagged rabbits in second sample}}$$

(ii) Advantage of using traps for distribution is that it is time saving. A disadvantage is that the wrong animals may get caught in the traps.

Advantage of using the tag/release method for abundance is that it causes little disruption to the area while a disadvantage is that the wrong animals may get caught in the traps or the animals may become wary of the traps for the 2nd sample.

The candidate gained full marks for the name and outline of a method for distribution and abundance. With the outline of a method only worth 1/2 a mark the formula for capture/tag was not required, even though this student included it in the answer.

The candidate also gained the marks for correct advantages and disadvantages of the distribution and abundance methods.

An example of a response scoring 1 mark

Common Mouse

(c) (i) Traps – lay traps in a distributed area and see what happens

Tag the animal for future sightings

(ii) Traps – advantage – measure distribution of species disadvantage could injure animal

Tag – advantage – keep track of animal

Disadvantage – make it look ugly

The candidate gained a 1/2 mark for mentioning traps were used for determining distribution. The outline of the method was not detailed enough to gain the 1/2 mark. The method used to determine the abundance lacked detail and gained no marks. The candidate scored a 1/2 mark for a correct disadvantage of traps for distribution — animals could be injured.

The marking scheme and a range of responses for Question 32(d)(iii) follow:

Marking Scheme

Human way 1	1/2 mark
How?/Why? Human way 1 increased the range/numbers	1/2 mark
Human way 2	1/2 mark
How?/Why? Human way 2 increased the range/numbers	1/2 mark
Human way 3	1/2 mark
How?/Why? Human way 3 increased the range/numbers	1/2 mark

An example of a response scoring 3 marks

(d) (iii) It is obviously too late to increase the range and numbers of Onychogalea fraenata as it is extinct.

1. Humans could work to eradicate introduced pests such as the feral cat and the rabbit, thus reducing the competition and predator of the Bilby and increasing numbers.
2. Land restoration and regeneration of Bilby's past habitats could increase the range of the animal.
3. By breeding and reintroduction programs to help the Bilby return to its previous distribution and previous numbers, Bilbies could be bred in captivity.

For human way 1, the candidate gained 1/2 mark for eradicating introduced species and 1/2 mark for stating this reduced predation and competition.

For human way 2, the candidate gained 1/2 mark for land restoration and a 1/2 mark for regeneration/increasing the habitats (resources).

For human way 3, the candidate gained 1/2 mark for breeding programs and a 1/2 mark for reintroducing them into habitats.

An example of a response scoring 2 marks

(d) (iii) Three ways in which humans may be able to increase the range and numbers of these marsupials are by

1. Breeding them and then releasing them into the wild, at different locations, so as to increase the range in which they are found.
2. Killing of introduced animals so that they are not used as prey by the introduced predators.
3. Breeding them in large abundances in captivity to increase the numbers and then slowly releasing them into the wild.

In human way 1, the candidate gained 1/2 mark for breeding and 1/2 mark for re-introducing/releasing them.

In human way 2, the candidate gained 1/2 mark for killing introduced animals and a 1/2 mark for stating predators removed.

Human way 3 was a repeat of the first way and no marks were awarded.

An example of a response scoring 1 mark

(d) (iii) Mating program like at the zoo

Keep them away from introduced animals

The candidate gained a 1/2 mark for mating programs in zoos but did not explain how this could increase range and numbers.

The candidate gained a 1/2 mark for keeping introduced species away but did explain how this could increase range/numbers.

Question 33 — Structure and Function of Cells and Tissues

The question was generally well answered with candidates showing a good knowledge of biochemistry and cell functions. Some candidates had difficulty in applying the knowledge in answering some sections.

Part (a) showed that most candidates had knowledge of Glycolysis, Krebs Cycle and Electron Transport. Sections (iii) and (iv) were poorly answered, requiring an understanding and application of some aspects of the biochemical pathways.

In part (b) (i) candidates correctly explained photolysis, and recognised that green light would not provide energy required but had trouble with section (iii), not realising the need for enzymes present in the grana in the process. Parts (iv) and (v) were well answered.

Candidates showed a good understanding of cell features and tissue functions in part (c).

Specificity of enzymes and the concepts of optimum pH and denaturation were well answered in part (d) (i). Part (d) (ii) presented candidates with graphical information, which some had difficulty in interpreting. The concept of pH changes (2) was answered better than more enzyme available (1) and reuse of enzymes (3).

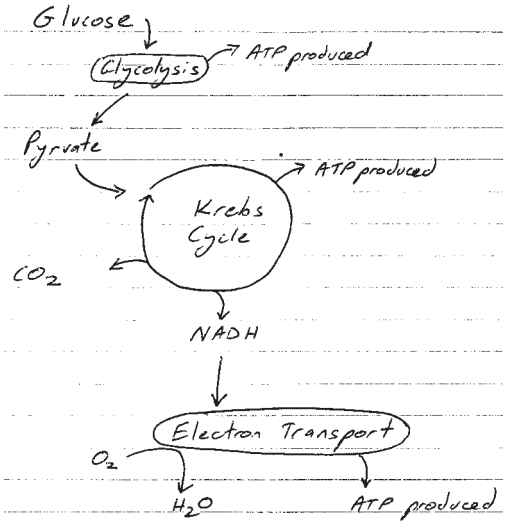
Part (e) (i) was poorly answered. Candidates had difficulty in explaining the structural changes of cells as they differentiate. Most presented the diagram of a root tip showing the meristematic, elongation and maturation zones. Part 2 of this question was answered well, with candidates relating the unique structures of cells to their functions.

The marking scheme and a range of candidate responses for Question 33 part (a) follows:

Marking Scheme

(a)	(i)	Glycolysis well explained	1 mark
		Poorly explained	1/2 mark
		Krebs Cycle well explained	1 mark
		Poorly explained	1/2 mark
		Electron Transport well explained	1 mark
		Poorly explained	1/2 mark
	(ii)	Krebs or Electron Transport well explained	1 mark
		Poorly explained, Stage named only	1/2 mark
	(iii)	Less ATP per molecule of glucose well explained	1 mark
		Poorly explained	1/2 mark
	(iv)	Solution A + correct explanation	1 mark
		Poor explanation (Solution A only)	1/2 mark
			Total = 6 marks

An example of a response scoring 6 marks



(ii) In solution B, the yeast cells could not use the Krebs cycle because it is part of the aerobic pathway which requires oxygen.

(iii) Glucose was used at a faster rate in Solution B because in the anaerobic pathway only 2 ATP are produced per glucose molecule compared to 36 ATP per glucose in Solution A.

(iv) Solution A would produce more during aerobic respiration because in the Krebs Cycle 3 carbon dioxides are produced from each pyruvate and only one carbon dioxide is produced from pyruvate in solution B during anaerobic respiration.

In (a) (i) the answer scored 1 mark for correctly identifying pyruvate as the product of glycolysis, 1 mark for NADH and carbon dioxide being produced in the Krebs Cycle and 1 mark for ATP being produced and oxygen being reduced to water during Electron Transport. In (b) Krebs was correctly identified and the correct reason given scoring 1 mark. The rate of glucose being used was correctly related to the amount of ATP generated in the aerobic and anaerobic pathways scoring 1 mark for part (iii).

An example of a response scoring 3 marks

(a) (i) The glucose molecule goes through the pathway of:

glycolysis
↓
Krebs cycle
↓
electron transport

(ii) Solution B cannot use Krebs Cycle

(iii) The faster rate is because Solution B can only use the anaerobic pathway

(iv) Solution A produces more carbon dioxide because it has more yeast cells

This answer scored 1 1/2 marks in (i) for naming glycolysis, Krebs Cycle and Electron Transport only. Part (ii) scored 1/2 mark for naming the pathway but no reason given, (iii) scored 1/2 mark for a poor explanation of the faster rate and (iv) scored 1/2 mark for correctly naming solution A but giving an incorrect reason.

An example of a response scoring 1 mark

(a) (i) Glucose $\xrightarrow{\text{glycolysis}}$ pyruvate

(ii) The fermentation process

(iii) The faster rate is because the pathway is shorter

(iv) Solution B because it has more yeast cells

The answer scored 1 mark in (i) for correctly identifying pyruvate as the product of glycolysis. No marks were scored in (ii), (iii) or (iv).

Question 34 — Control and Coordination

Most candidates answered all parts with very few non-attempts.

(a) Part (i) was frequently answered with a table and generally well done. Some candidates are still not skilled in comparing, giving only hormonal or nervous aspects of a particular difference.

The majority of candidates understood the role of the hypothalamus with some giving a high level of detail. Most could name a pituitary hormone and its target although ‘tissue’ examples were sometimes given. Many (b) part (ii) responses showed that few candidates knew enough detail about how the hypothalamus controls the pituitary. In (b) part (iii) a large number of candidates did not understand, or failed to give enough detail, about pituitary control in terms of wider feedback, giving general statements or incorrect parts of feedback mechanisms.

The majority of candidates explained hormone specificity by giving simple ‘lock-key’ style drawings for part (c), many scoring well.

Despite directions for part (d) some candidates put more than one feature of the phototrophic response in a single part of the flow chart, or some components out of sequence or in some cases fewer than the five parts required. The general wording of some answers in (d) parts (i) and (iii) showed that these candidates lacked the specific terminology or understanding of the nature of the phototrophic response.

The marking scheme and a range of candidate responses for Question 34 parts (d) and (e) follow:

Marking Scheme

(d) (i) definition of phototropism — 1 mark

(ii) flow chart giving five correct parts in sequence — 3 marks

(iii) advantage of the plant of phototropism — 1 mark

An example of a response scoring 5 marks

(d) (i) Phototropism is the plants growth response to the stimulus of light — 1 mark

(ii) stimulus → receptor → hormone →

light — cells in the shoot tip — I.A.A. produced on the darker side of shoot

Plant Response → Cellular Response

Plant tip bends towards light — Cells on dark side elongate

— 3 marks

(iii) This allows the plant to maximise light absorption for photosynthesis — 1 mark

An example of a response scoring 3 marks

(d) (i) where a plant reacts to light — 0 marks

(ii) sun (stimulus) — 2 marks

↓

shoot (receptor)

↓

auxin (hormone)

↓

cell elongation (cellular response)

↓

plant bends towards light (plant response)

(iii) It allows the plant to face the light and make maximum use of the available light for photosynthesis — 1 mark

An example of a response scoring 1/2 a mark

(d) (i) Phototropism is a response to a stimulus that brings about a change in the growth of the plant.

(ii)

light	stimulus
↓	↓
leaf tip	receptor
↓	↓
florigen	hormone
↓	↓
cell growth	cellular response
	↓
	plant response

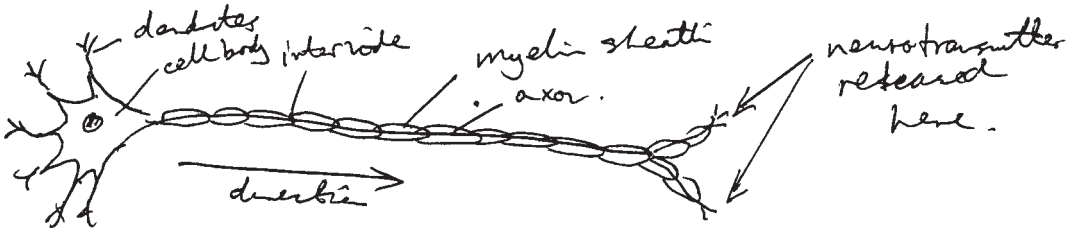
1/2 mark

(iii) So that the plant can grow better.

Parts (e)–(g)

Overall, these parts of the question were done reasonably well by the majority of candidates. There was some confusion as to the shape of a motor neurone and the direction of the nerve impulse. Most candidates scored some marks for correct labels.

An example of a response scoring 4 marks



1/2 mark for diagram as recognisable motor neurone.

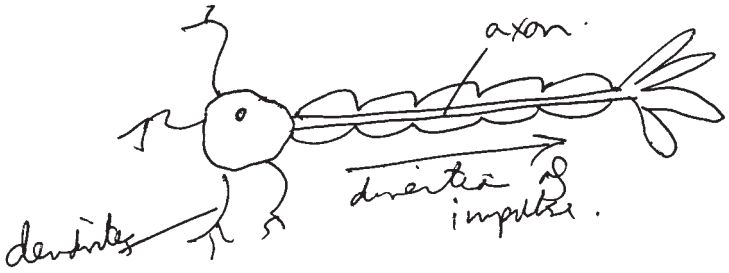
(i) 1/2 mark for each correct label (2 labels) + 1/2 extra for extra label

1 1/2 marks

(ii) 1 mark for label showing neurotransmitter

(iii) 1 mark for indication of correct direction of impulse

An example of a response scoring 2 1/2 marks



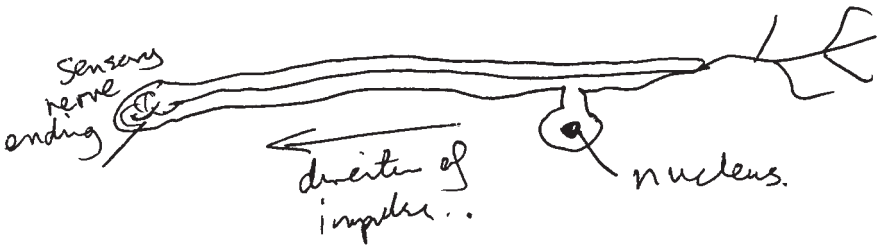
1/2 mark for diagram

(i) 1/2 + 1/2 for correct labels 1 mark

(ii) 0 marks for neurotransmitter

(iii) 1 mark for correct direction of impulse

An example of a response scoring a 1/2 mark



O for diagram

(i) 1/2 mark for correct label — sensory nerve ending (correct for this neurone)

(ii) 0 for label of neurotransmitter

(iii) 0 for direction of impulse

Question 35 – Classification and the Species Concept

Parts (a) and (b)

These two parts were generally well answered. Most candidates were able to correctly rank the categories of classification starting with Kingdom, the largest group. Likewise in (a) (ii), the response was good although some candidates only defined the 'biological species concept' rather than stating how it could be used to distinguish organisms from different species.

Responses to part (b) demonstrated candidates had a good grasp of the use of scientific nomenclature and naming organisms using the binomial system.

Part (c) (i) and (ii)

Clearly, from the many excellent responses to this part of the question, candidates generally enjoyed learning the scientific names of local native plant species. Some candidates, however, did have trouble with the family name and mispellings were common. Also some responses confused

family name with the genus and others only gave the initial of the genus for both species named. A floral characteristic of the family was probably the least well answered part of this question.

(iii) While many students scored well in this part of the question, some were unable to use the features shown in the diagrams to adequately separate each species. The list of distinguishing features given was sometimes non-descriptive and simply stated the name of a part of the plant, eg 'leaves' or 'flowers' or 'buds'. All diagrams showed leaves, flowers and buds. Adequate descriptions recorded in scripts included 'leaf shape' or 'leaf size' or 'inflorescence shape' etc.

In the second part of (iii), responses which did use the listed features to separate each species were often in the form of a table. This was acceptable provided it was well set out and included descriptive comparisons. The use of one feature to distinguish one of the species from the other two and then a different feature to separate the latter two species from each other was also acceptable and scored full marks. In comparing characteristics such as leaf length or inflorescence length between species, actual measurements or comparative dimensions were expected, but 'bigger' or 'longer' were not acceptable.

The marking scheme and a range of candidate response from Question 35 part (c) follow.

Marking Scheme

(c)	(i)	For giving the scientific name of the family of plants studied	1/2 mark
		Binomial names of two species within that family — must be from the family stated or if correct family can be inferred from (ii). (1/2 mark for each correct genus and each correct species name)	2 marks
	(ii)	One correct floral feature common to the family listed in (i)	1/2 mark
2.		Listing three diagnostic features of the species shown (1/2 mark for each feature)	
		Use of one, two or all three features listed to distinguish each species from each other species in the field (1/2 mark for each pair of species distinguished)	3 marks
		Total	6 marks

An example of a response scoring 6 marks

(c)	(i)	Proteacea	1/2 mark
		Banksia serrata	1 mark
		Banksia integrifolia	1 mark
	(ii)	Four stamens per flower	1/2 mark
	(iii)	1. Leaf size	(1/2 mark)
		2. Inflorescense shape	(1/2 mark)
		3. Position of fruit	(1/2 mark)
		Species one, leaves 1 1/2 cm long; species two, leaves 1 cm long; and species three, leaves 4 cm long	1 1/2 marks
		Total	6 marks

An example of a response scoring 2 1/2 marks

(c)	(i)	Myrtaceae	1/2 mark
		Eucalyptus gummifera	1 mark
		Banksia ericifolia	0 mark
		Banksia ericifolia is a member of the family Proteacea not Myrtaceae	
	(ii)	ovary is superior	0 mark
		All members of the Myrtaceae have inferior ovaries	
	(iii)	1. leaves	0 mark
		2. flowers	0 mark
		the presence of leaves and flowers are not features that can be used to identify each species. Response must indicate how the feature may differ between species i.e. shape, size or position	
		3. shape of fruit	1/2 mark
		Leaves are opposite in species one and two but Alternate in species three.	1/2 mark
		Only two species separated. If response had included that in species one, flowers are twice the size of species two, all three species would have been separately identified and gained 1 1/2 marks	
		Total	2 1/2 marks

(d) (i) The concept of speciation was tested in this part of the question. Most candidates recalled some material they had studied with regard to the most commonly proposed means of the formation of new species — often referred to as allopatric speciation. This is where genetic variation is acted on by natural selection after groups of a single species have become physically (geographically) separated from each other and therefore 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. The majority of candidates were not familiar with the proposed concept of sympatric speciation, where new forms can arise within an area, without populations of the original species being physically isolated from each other. This can result from intense selection in a specific part of a population's distribution, by behavioural change and inbreeding between individuals within part of the population, by 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 and cannot interbreed to produce fertile offspring with the original forms they are recognised as new species. The last two of these processes involve polyploidy and are most common in the evolution of new plant species.

The syllabus asks students to study 'hypotheses to account for speciation'. Although the allopatric hypothesis only is treated in most of the current text books used in schools for the HSC course, the concept of sympatric speciation is comprehensively dealt with in all modern general biology text books.

The marking scheme and a range of candidate responses for Question 35 (d) (i) follow:

Marking Scheme

(d) (i) Demonstration of an understanding of the concept of sympatric speciation, ie changes occurring within a population of organisms of a single species within a single area.

1 mark

This is due to:

formation of a mutant or hybrid forms or polyploids or behavioural change in one section of the population or intense natural selection in a localised area or

human-induced genetic change (eg hybrids recombinant forms). 1/2 mark

And results in:

offspring being unable to breed with other members of the original population or reproductive isolation of these forms from other members of the original population.

1/2 mark

TOTAL 2 marks

As candidates demonstrated good knowledge of allopatric speciation and used their understanding to indicate that reproductive isolation does occur between new species formed in this way, due to the mutations selected by natural selection, by behavioural changes preventing reproduction and by other reproductive isolating mechanisms, they were awarded marks in the second two parts of this section for demonstrating this knowledge of an understanding of a process of speciation.

An example of a response scoring 2 marks

(d) (i) Speciation can occur in the absence of geographical isolation through a mutation which develops in one group of the population in an area which means that they can't successfully breed with the others any more. This happens mostly in plants. 1/2; 1 mark 1/2 mark

An example of a response scoring 1 mark

(d) (i) Speciation can occur with other isolations such as seasonal, behavioural etc the mating call of a bird may differ and be unrecognisable to another of the same species and so one group stops breeding with another group. 1/2 mark 1/2 mark

An example of a response scoring 1/2 a mark

(d) (i) Through a mutation that develops in a species and this mutation proving favourable to the environment. 1/2 mark

(d) (ii) This part was mainly well done, with candidates realising that divergence between isolated populations would not occur if their environments were similar throughout that time or did not change during the time. Some candidates gave excellent answers, indicating that the two populations would not change if they had been exposed to similar selection pressures.

(iii) Most candidates recognised that mutation, crossing over, independent assortment of chromosomes at meiosis and random mating are the main reasons for the occurrence of genetic variability and indicated that increasing these would increase variability. However, as the question asked them to 'describe' they needed to say how the increase in variability came about. Although many students gave good descriptions, some simply listed one of the above (eg mutation).

(iv) Candidates found this part of the question more difficult than (d) (iii) but some were able to select processes, (eg inbreeding, asexual reproduction) which would lead to reduced variability.

(e) (i) Most candidates gave an adequate definition of a cline, although some were penalised for not indicating that the characteristics of the species changed along the environmental gradient, suggesting by their answers that the gradual change was occurring in the environment and not necessarily resulting in a change in the species.

(ii) This part of the question was much more poorly answered. Many candidates did not recognise that a cline may represent speciation in progress, but that speciation will not generally be completed unless gene flow is stopped by two parts of the cline being geographically isolated from each other.

(f) (i)–(iii) This part was well done by the majority of candidates but it was surprising to find that some still wanted to say that an eight-legged organism with two distinct body parts was an insect! The simple key was used well, although some candidates failed to put in all of the steps they took to reach the correct order name, including the letters (eg 1b - 2b).

Question 36 — The Human Species

(a) (i) Most candidates were able to list two features of mammals that were unique to the group.

(ii) The majority of candidates were able to list two primates and two features of primates.

Generally, part (a) was well done.

(b) Most candidates chose 'social structure' or 'impact on the biosphere' or at least implied one or the other in answering this question.

(i) The majority of candidates could list two archaeological artifacts but then failed to show how it related to a fossil of Homo Sapiens.

(ii) A lot of candidates found it difficult to show a limitation of such evidence.

(c) This question was generally poorly done. Very few candidates gave specific examples and explanations of:

(i) changed views within the scientific community concerning evolution of modern humans.

(ii) different theories of human evolution based on the same evidence.

Some candidates were able write generally without giving a specific example.

(d) The majority of candidates answered this part of the question satisfactorily. Some, however, were unsure of the time at which some cultural developments occurred and so did not limit their answers to the past 40,000 years as was required. As a consequence, those who chose 'fire' and 'tools', especially, needed to discuss the changes that occurred later rather than earlier in human history.

The question required candidates to list three areas in which there has been a development during the past 40,000 years AND to outline the benefit that this development was to the species. Both the area of development and the benefit needed to be precise examples showing a direct link between development and benefit. Students are advised against using vague generalisations such as 'to hunt better', 'for an easier life' and 'so they live longer' unless these statements are further qualified.

Examples of student responses to Question 36 (d) follow:

Response scoring 3 marks

The development of writing gave a permanent record of events that could be available to many people at the same time.

The development of agriculture resulted in people settling in one place and developing laws to control their society.

Methods of transport have changed from 'foot' to 'horse' to 'cars'. This has meant an increase in the speed and distances that people could travel.

Response scoring 2 marks

Agricultural revolution — agriculture became more advanced and gave humans time to develop arts and crafts

Advanced tools made from materials such as copper allowed for the creation of complex objects, houses, better transport etc.

The use of fire enabled humans to keep warm in cold climates.

No mark was awarded for this part of the response relating to fire.

Response scoring 1 mark

Language has been a cultural development. With the need for communication between humans the use of language has increased.

The development of agriculture resulted in a greater production of food.

The use of fire meant that humans did not have to eat raw food.

The only part of the response to score a mark was that relating to language.

Response scoring 0 marks

The development of speech meant that people could talk to each other.

Burial of dead people showed that humans had feelings for one another.

Tools were developed which made it easier to hunt.

(e) (i) This section was generally well answered. Candidates were asked to identify two of the features that represented an evolutionary advance, not simply to describe the differences between the skulls of Homo Erectus and Homo Sapiens.

(ii) Most candidates recognized that the feature that enabled advances was the increase in the size of the brain so this section was answered well.

(f) The standard of answers in this part of the question were reasonable but many candidates were not able to clearly differentiate between palaeontology and archaeology. Each section needed to be linked back to the question by comparing similarities between Aboriginal factors and South-East Asian factors OR by linking differences within Australian Aboriginal factors to successive waves of migration.

(i) Reasonably well answered. Failure to discuss human fossils was a problem for some candidates.

(ii) Well answered.

(iii) Anthropological evidence was generally well handled. Some confusion is evident between the idea of land-bridges during the ice age allowing a migration pathway and isolation resulting from continental drift / Gondwanaland concepts.

(g) This part of the question was well answered. The majority of candidates displayed a sound understanding of polymorphic differences and the advantages they provide and the conditions that create the advantage.

Students should note that when a physical feature or difference is required, they should refer to the feature and not an example of the feature, eg skin colour, not dark skin.

(h) (i) A number of candidates were unable to distinguish between genetic and medical techniques in this section. Students need to be precise when explaining how genetic techniques can influence evolution, eg causes a change in the gene pool

(ii) Many candidates, in this part of the question were able to describe the influence of birth control and medicine on evolution. The answer also required an explanation of ‘how’.

Question 37 — Genes in Action

In this question a detailed understanding was required for full descriptions of:

- human ABO blood group system and human height inheritance;
- the roles of messenger RNA, transfer RNA and ribosomes in protein synthesis;
- chromosomal mutations which do not involve a change in chromosome number;
- the relationship between crossing over, percentage recombination of genes and distance between genes on a chromosome.

Descriptions can include fully labelled diagrams as in protein synthesis ((b) (ii)) and production of recombinant human insulin ((f) (ii)).

Range of candidate responses for a number of parts of Question 37 follow:

(b) (i) Question: *Explain why the genetic code requires triplets of bases to specify an amino acid, rather than just pairs of bases or single bases.*

Response example

If only 1 or 2 bases are used, there are not enough combinations to code for all amino acids. 1/2 mark

If only 1 or 2 bases are used, there are not enough combinations to code for all amino acids, however if 3 bases are used there are more than enough combinations for the variety of amino acids. 1 mark

If only 1 base is used, then only 4 amino acids can be coded for. If 2 bases are used, only 16 (42) different arrangements are possible. If 3 bases are used, then there are 64 (43) possible combinations which is more than enough to code for all 20 amino acids. 1 1/2 marks

(e) (ii) Question: *Some mutagens can induce frameshift mutations. What is a frameshift mutation?*

Response examples

Frameshift mutations are mutations involving the addition or deletion of bases. 1/2 mark

Frameshift mutations are mutations involving the addition or deletion of bases. This causes every triplet after the insertion or deletion to change

eg AAT TGC CCA

AG*A TTG CCCA

The G* has been inserted. All triplets which occur after this inserted base are then misread as the sequence of bases has been changed. 1 mark

(f) (i) Question: *What is recombinant DNA?*

Response examples

Recombinant DNA is DNA that has a new piece spliced in. 1/2 mark

Recombinant DNA is DNA that has had a piece cut and removed, and then a new piece of DNA inserted. 1 mark

(f) (ii) Question: *Outline the steps involved in the production of recombinant human insulin.*

Response examples

Insulin can be produced by cutting a piece of DNA from a plasmid and inserting the human gene for insulin into the plasmid. 1 mark

The gene for insulin is cut from human DNA and inserted into the DNA of a plasmid. This plasmid is placed back into bacteria which reproduces, cloning the insulin gene. 1 1/2 marks

A plasmid is removed from bacteria and a piece cut out. The gene for insulin is cut from human DNA. This is inserted into the plasmid. The plasmid is placed back into the bacteria. As the bacteria reproduces, the insulin gene is cloned. 2 marks

A fully labelled diagram could have been used to show all the steps involved in the production of recombinant human insulin.

Question 38 — Human Environmental Impact

It is strongly recommended that students only attempt this elective if they have studied the relevant course material in detail. Candidates need to ensure that they write responses which demonstrate that they understand and can use scientific language. Answers require specific information expressed succinctly with supporting data or evidence, rather than generalisations. Students need to respond appropriately to key directions such as describe, outline and explain.

The marking scheme and a range of candidate responses for Question 38 (a) follows:

Marking Scheme

(a)
- poor hygiene/sanitation — 1 mark
- inefficient agricultural practices — 1 mark
- poor medical knowledge/technology — 1 mark

An example of a response scoring 3 marks

(a) Poor hygiene and sanitation resulted in a high incidence of infectious disease leading to a high death rate. Agricultural practices were inefficient resulting in a scarcity of food and, consequently, a high death rate. Medical knowledge was very poor and led to a high death rate.

An example of a response scoring 2 marks

(a) Medicines had not yet been developed, so large numbers of people became sick and died.

Agriculture was labour-intensive and not as productive as it later became. 1 mark

Lack of understanding of hygiene meant many people died of disease. 1 mark

An example of a response scoring 1 mark

(a) Many wars killed large numbers of people.

Birth rate equalled death rate. Treatment of disease was

unscientific because there was little medical knowledge. 1 mark

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