

**2003 HSC Notes from
the Marking Centre
Biology**

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Published by Board of Studies NSW
GPO Box 5300
Sydney 2001
Australia

Tel: (02) 9367 8111
Fax: (02) 9367 8484
Internet: www.boardofstudies.nsw.edu.au

ISBN 1 7409 9991 6

2004037

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2003 HSC NOTES FROM THE MARKING CENTRE

BIOLOGY

Introduction

This document has been produced for the teachers and candidates of the Stage 6 course in Biology. It provides comments with regard to responses to the 2003 Higher School Certificate Examination, indicating the quality of candidate responses and highlighting the relative strengths and weaknesses of the candidature in each section and each question.

It is essential for this document to be read in conjunction with the relevant syllabus, the 2003 Higher School Certificate Examination, the Marking Guidelines and other support documents which have been developed by the Board of Studies to assist in the teaching and learning of Biology.

General Comments

In 2003, approximately 12 159 candidates attempted the Biology examination. The most popular option in 2003 was Communication followed by Genetics – The Code Broken? and the Human Story. The Biochemistry option was selected by very few candidates in 2003.

Teachers and candidates should be aware that examiners may ask questions that address the syllabus outcomes in a manner that requires candidates to respond by integrating their knowledge, understanding and skills developed through studying the course. This reflects the fact that the knowledge, understanding and skills developed through the study of discrete sections should accumulate to a more comprehensive understanding than may be described in each section separately. There was evidence that candidates who spent some time planning their response to the specific question being asked tended to achieve better marks. Candidates should be guided by the key word and the mark allocation for the depth of treatment required in a response.

Section I – Core

Part A – Multiple choice

Question	Correct Response
1	D
2	A
3	B
4	C
5	D
6	B
7	B
8	C

Question	Correct Response
9	A
10	B
11	D
12	C
13	B
14	A
15	D

Part B

General Comments

Overall, the responses indicated that the majority of candidates had a good grasp of biological concepts, appropriate for HSC Biology. Candidates need to be aware that the answer space allocated is a guide to the length of the required response; some candidates exceeded the space provided.

Specific Comments

Question 16

This question was generally well answered.

- (a) Candidates did have difficulty interpreting the graph. Responses that identified organism I as either an ectotherm or an endotherm were accepted.
- (b) Most responses included examples of Australian reptiles although there was a large range of Australian ectothermic animals given as an answer.
- (c) Appropriate responses were given for temperature control when ambient temperature increases.

Question 17

- (a) This question assessed skills in scientific method and experimental design. There were a number of acceptable methods of producing carbon dioxide. Some candidates were unsure how to test for pH and did not list controls.
- (b) Most candidates understood why carbon dioxide needed to be removed from cells.

Question 18

The response required a labelled diagram. A flow chart was an acceptable way to answer the question. Some responses demonstrated a poor understanding of homeostasis and the concept of feedback. Some candidates struggled to convert their knowledge about feedback mechanisms into a diagrammatic form.

Question 19

The responses demonstrated that most candidates understood the development of resistance. However, some candidates used examples other than bacteria.

Question 20

- (a) Most candidates were able to state one mutagenic radiation.
- (b) Most candidates were able to describe evidence. Poorer responses referred to cancer rather than a more specific effect (skin cancer, etc).

Question 21

- (a) Candidates listed many types of technology, not all related to establishing evolutionary relationships.
- (b) In this part, there was confusion between technology used to establish evolutionary relationships and areas of study to support the theory of evolution.

Question 22

Most candidates displayed an understanding of 'genetically modified'. Many candidates exceeded the space given to answer this question. There was some confusion between genetic modification and reproductive technologies. A minority of responses did not focus on bio-ethics, instead using generic statements in attempting to answer the question.

Question 23

- (a) The definition of enantiostasis caused problems for candidates.
- (b) Most candidates were able to outline appropriate methods of salt regulation in estuarine plants. A minority of candidates used examples other than estuarine (eg saltbush).

Question 24

- (a) A significant number of candidates were unable to describe the work of Franklin and how it contributed to identifying the structure of DNA.
- (b) Most candidates were able to link DNA discovery with its impact on current genetic technology. Some candidates discussed DNA discovery rather than current technology. The better responses made a judgement on the impact of DNA structure on genetic technology.

Question 25

The question focussed candidates on the use and limitations of models but did not necessarily require them to refer only to first-hand investigations. Most candidates provided points for and/or against the use and limitations of models.

Question 26

Better responses clearly identified the differences, defined the terms and gave good examples.

Question 27

While the question did not ask for definitions of 'disease' and 'health', the responses that scored well used these definitions to provide points relating to the difficulties using them.

Question 28

Many responses included descriptions of secondary immune responses and linked this to the vaccination program. Most candidates correctly proposed that a reason for the frequent vaccinations was the immaturity of the immune system of infants.

Question 29

Many candidates demonstrated a good understanding of collecting data in this type of study; the better responses included some analysis of the data. Some candidates found the stimulus material confusing and attempted to answer the question from the viewpoint of an infectious disease even though the information stated that this was not the cause. There were some candidates who did not understand the concept of an ‘epidemiological study’, attempting to find the cause of the disease rather than design a study. Many candidates wrote more than the space provided. Some candidates did not attempt to answer the question.

Section II – Options

General Comments

Overall, the candidates’ responses were appropriate and indicated a level of understanding expected of HSC candidates. A small number of candidates responded to more than one question in this section and there was some evidence of candidates attempting options that they had not studied. These candidates tended to score low marks.

Question 30 – Communication

- (a) This question required candidates to demonstrate knowledge of specific receptors. Many candidate responses indicated a poor knowledge of receptors.
- (b) (i) Most candidates were able to state a possible cause for the loss of sight in one eye. Better responses clearly linked the cause to a described industrial accident.

(ii) Many candidates were able to identify more than one way in which vision may be affected. However, responses indicated that candidates had some difficulty relating the loss of sight in one eye to the specific impact on other aspects of vision.
- (c) (i) Most responses correctly identified the frog.

(ii) Many responses described the ranges of hearing of various animals rather than providing reasons for the differences in the ranges of hearing. Poorer responses indicated that candidates had difficulty using this type of graph.
- (d) (i) This skills-based question was poorly answered by a number of candidates. Better responses included detailed descriptions of techniques such as summarising, comparing sources for readability, reliability, and relevance as well as the use of models, flow charts and graphs. Poorer responses addressed the stimulus material rather than the question asked; they gave detailed descriptions of gathering rather than processing and analysing, and answers that confused first-hand investigations with information from secondary sources.

- (ii) This question was well answered by most candidates.
- (e) Most candidates could identify a range of technologies to deal with vision and hearing impairment and a majority could describe features of these technologies. Better responses made a judgement relating to advantages and limitations of the technologies considered. Many candidates wrote unnecessarily long responses to this question.

Question 31 – Biotechnology

- (a) (i) This question was well answered.
 - (ii) Most candidates could provide a correct description. A number of responses incorrectly described transgenic species.
- (b) (i) While many candidates correctly outlined alcohol production, a number did not mention carbon dioxide as a by-product. Some candidates focused on the distillation of alcohol rather than on the fermentation process. Responses outlining the production of bread were overall of poorer quality, with many candidates neglecting to mention the role of carbon dioxide.
 - (ii) Candidates found this question difficult. Many responses were general and did not explain the link between changes in production and specific scientific knowledge.
- (c) (i) This question was well answered.
 - (ii) Many candidates could identify a correct enzyme but fewer candidates could give an adequate description of the function of the enzyme. A significant number of candidates listed terms such as “sticky ends” with no related description. Candidates should be guided by the verb and the mark allocation for the depth required in a response.
- (d) (i) This skills-based question was poorly answered by a number of candidates. Better responses included detailed descriptions of techniques such as summarising, comparing sources for readability, reliability, and relevance as well as the use of models, flow charts and graphs. Poorer responses addressed the stimulus material rather than the question asked; they gave detailed descriptions of gathering rather than processing and analysing, and answers that confused first-hand investigations with information from secondary sources.
 - (ii) This question was well answered by most candidates.
- (e) The better responses made a clear judgement of the impact of industrial fermentation biotechnology, either on the industry or on wider society. Most responses included a description of some of the uses of industrial fermentation biotechnology. However, descriptions of the advantages and disadvantages of the processes were too generalised.

Question 32 – Genetics – The Code Broken?

- (a) (i) Candidates had difficulty defining recombinant DNA, although responses to (a) (ii) would indicate the process was well understood. Responses indicated some confusion with DNA replication and DNA-DNA hybridisation.

- (ii) Generally well answered, with many of the better responses including labelled diagrams.
- (b) (i) Very well answered.
- (ii) Generally, responses referring to SCIDS or cystic fibrosis were clear, concise and demonstrated a good level of understanding of gene therapy. Weaker responses tended to focus on symptoms or management of the disease without giving any points for/against their use.
- (c) (i) Generally well answered. Many candidates provided information beyond the requirements of the question.
- (ii) Better responses interpreted the DNA fingerprint data provided in the stimulus material.
- (iii) Most candidates correctly stated that DNA fingerprinting was more accurate in paternity testing. Fewer students could provide an appropriate reason as to why DNA fingerprinting was more accurate. A considerable number of candidates elected to approach the question by explain why ABO blood testing was less accurate.
- (d) (i) This skills-based question was poorly answered by a number of candidates. Better responses included detailed descriptions of techniques such as summarising, comparing sources for readability, reliability, and relevance as well as the use of models, flow charts and graphs. Poorer responses addressed the stimulus material rather than the question asked; they gave detailed descriptions of gathering rather than processing and analysing, and answers that confused first-hand investigations with information from secondary sources.
- (ii) This question was well answered by most candidates.
- (e) The best responses included a description of gene cloning with examples, some discussion of the advantages and disadvantages of the technology and made a judgement of the impact of gene cloning. A significant number of responses related to whole organism cloning rather than gene cloning.

Question 33 – The Human Story

- (a) This question was generally well answered.
- (b) (i) The majority of candidates correctly indicated the main features of ‘absolute dating’ however, the concept of ‘relative dating’ was not as well understood.
- (ii) This question was generally poorly answered. Better responses gave two reasons. Many of these gave ‘paucity of the fossil record’ as a reason for uncertainty and related this to the uncertainty of evolutionary relationships within the speculative family tree.
- (c) (i) Generally well answered. Better responses linked some specific data about blood group B with migration or isolation.
- (ii) Most candidates identified isolation as a contributing factor. Better responses clearly linked isolation or lack of interbreeding over a long period of time with described variations in blood group percentages.

- (d) (i) This skills-based question was poorly answered by a number of candidates. Better responses included detailed descriptions of techniques such as summarising, comparing sources for readability, reliability, and relevance as well as the use of models, flow charts and graphs. Poorer responses addressed the stimulus material rather than the question asked; they gave detailed descriptions of gathering rather than processing and analysing, and answers that confused first-hand investigations with information from secondary sources.
 - (ii) This question was well answered by most candidates.
- (e) Better responses gave a detailed account of the model selected, described evidence to support the model and made a judgement on the quality of the evidence supporting the model. Some candidates used contrasting evidence from the other model to strengthen the judgement.

Question 34 – Biochemistry

- (a) (i) Few candidates could identify the thakaloids.
 - (ii) Many candidates could not indicate the main features of the function of thakaloids.
- (b) (i) Few candidates could identify the reactants required for ATP production.
 - (ii) The Calvin Cycle and the role of NADPH were not well understood.
- (c) (i) Few candidates were able to recall Van Helmont's conclusions about soil not being primarily responsible for the plants' increased weight.
 - (ii) Most candidates responded in general terms about the use of radioactive tracers.
- (d) (i) This skills-based question was poorly answered by a number of candidates. Better responses included detailed descriptions of techniques such as summarising, comparing sources for readability, reliability, and relevance as well as the use of models, flow charts and graphs. Poorer responses addressed the stimulus material rather than the question asked; they gave detailed descriptions of gathering rather than processing and analysing, and answers that confused first-hand investigations with information from secondary sources.
 - (ii) This question was well answered by most candidates.
- (e) Better responses described non-renewable resources that can be replaced with products of photosynthesis, explained how photosynthesis can be used to produce alternative products and made a judgement regarding the use of photosynthetic products.

Biology

2003 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I Part A			
1	1	9.2.1 (transpired/loss)	H8
2	1	9.4.5 (McF/Barnett)	H1, H4
3	1	9.2.1 (temp reg)	H8
4	1	9.2.2 (blood products)	H4, H5
5	1	9.4.3 (Pasteur)	H2, H11
6	1	9.4.3 (malaria)	H1, H8
7	1	9.2.1 (enzyme)	H6
8	1	9.4.5 (T cells)	H6, H4
9	1	9.3.3 (meiosis)	H9
10	1	9.3.3 (bases DNA)	H9
11	1	9.4.2 (burger)	H4
12	1	9.3.2 (PKU recessive)	H9
13	1	9.2.2 (xylem/phloem)	H6
14	1	9.3.2 (albinism)	H9, H10
15	1	9.3.3 (sex linkage)	H9, H10

Question	Marks	Content	Syllabus outcomes
Section I			
Part B			
16 (a)	1	9.2.1 (temp response endo/ecto)	H7, H14
16 (b)	1	9.2.1 (temp response endo/ecto)	H7, H14
16 (c)	2	9.2.1 (temp response endo/ecto)	H7, H14
17 (a)	3	9.2.2 (CO ₂ /pH water)	H11, H13
17 (b)	2	9.2.2 (CO ₂ /pH water)	H11, H13
18	4	9.2.1 (feedback)	H4, H13
19	3	9.4.3, 9.3.4, 9.3.1 (antibiotic resist)	H4, H7, H10
20 (a)	1	9.3.4 (mutagens)	H6, H10
20 (b)	2	9.3.4 (mutagens)	H6, H10
21 (a)	1	9.3.1 (DNA evol relat)	H3, H5, H6
21 (b)	2	9.3.1 (DNA evol relat)	H3, H5, H6
22	4	9.3.5 (GMO's)	H4
23 (a)	1	9.2.3 (enantiostasis)	H4, H7
23 (b)	2	9.2.3 (enantiostasis)	H4, H7
24 (a)	2	9.3.4 (Rosalind Franklin)	H5
24 (b)	6	9.3.4 (Rosalind Franklin)	H5
25	4	9.3.1 (Nat Selection)	H11, H13, H12, H14.1
26	3	9.3.2 (Allele/gene)	H9, H10
27	5	9.4.1 (cell function)	H6, H8
28	4	9.4.5 (vaccines)	H3, H4
29	4	9.4.6 (epidemic)	H1, H11, H13
Section II			
Question 30 — Communication			
30 (a) (i)	1	9.5.1, 9.5.2	H4, H8
30 (a) (ii)	1	9.5.1, 9.5.2	H4, H8
30 (a) (iii)	1	9.5.1, 9.5.2	H4, H8
30 (b) (i)	2	9.5.7, 9.5.3	H4, H8
30 (b) (ii)	3	9.5.3, 9.5.4	H8, H13
30 (c) (i)	1	9.5.5	H4, H14
30 (c) (ii)	4	9.5.6	H4
30 (d) (i)	4	9.5.6	H12
30 (d) (ii)	1	9.5.6	H14
30 (e)	7	9.5.3, 9.5.6, 9.5.7	H1, H3, H4, H11, H16

Question	Marks	Content	Syllabus outcomes
Question 31 — Biotechnology			
31 (a) (i)	1	9.6.1	H10
31 (a) (ii)	2	9.6.1	H10
31 (b) (i)	2	9.6.2	H9, H10
31 (b) (ii)	3	9.6.3	H9, H10
31 (c) (i)	2	9.6.4, 9.6.5	H3, H14
31 (c) (ii)	3	9.6.5	H3, H6
31 (d) (i)	4	9.6.5	H12
31 (d) (ii)	1	9.6.5	H14
31 (e)	7	9.6.2, 9.6.3, 9.6.7, 9.6.6	H4
Question 32 — Genetics – The Code Broken?			
32 (a) (i)	1	9.7.4	H9
32 (a) (ii)	2	9.7.4	H9
32 (b) (i)	2	9.7.4, 9.7.5	H7
32 (b) (ii)	3	9.7.5	H7
32 (c) (i)	1	9.7.2, 9.7.3	H9
32 (c) (ii)	1	9.7.2, 9.7.3	H9
32 (c) (iii)	3	9.7.2	H9, H12
32 (d) (i)	4	9.7.8	H12
32 (d) (ii)	1	9.7.8	H14
32 (e)	7	9.7.7, 9.7.4, 9.7.6	H4, H10
Question 33 — The Human Story			
33 (a) (1)	1	9.8.1	H6, H7
33 (a) (2)	1	9.8.1	H6, H7
33 (a) (3)	1	9.8.1	H6, H7
33 (b) (i)	2	9.8.2	H3, H6, H9
33 (b) (ii)	3	9.8.2	H3, H6, H9
33 (c) (i)	1	9.8.4	H6, H9, H14
33 (c) (ii)	4	9.8.4	H6, H9
33 (d) (i)	4	9.8.6	H12
33 (d) (ii)	1	9.8.6	H14
33 (e)	7	9.8.3	H1, H2, H4

Question	Marks	Content	Syllabus outcomes
Question 34 — Biochemistry			
34 (a) (i)	1	9.9.8	H6
34 (a) (ii)	2	9.9.8	H6
34 (b) (i)	1	9.9.7	H6
34 (b) (ii)	4	9.9.6	H6
34 (c) (i)	2	9.9.2	H6
34 (c) (ii)	3	9.9.5	H12, H14
34 (d) (i)	4	9.9.1	H12
34 (d) (ii)	1	9.9.1	H14
34 (e)	7	9.9.1, 9.9.2, 9.9.3, 9.9.4, 9.9.5, 9.9.6, 9.9.7	H1, H2, H3, H4, H6, H8, H11, H13, H16

2003 HSC Biology Marking Guidelines

Question 16 (a)

Outcomes assessed: H7, H14

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> Correct term stated 	1

Question 16 (b)

Outcomes assessed: H7, H14

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> Correctly named Australian animal 	1

Question 16 (c)

Outcomes assessed: H7, H14

MARKING GUIDELINES

Criteria	Marks
<ul style="list-style-type: none"> Correct example of response Effect the response has on body temperature 	2
<ul style="list-style-type: none"> Correct example of response OR <ul style="list-style-type: none"> Effect the response has on body temperature 	1

**Question 17 (a)***Outcomes assessed: H11, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Describes appropriate method to deliver CO₂ to water• Includes a valid control• Includes a method to determine pH of solution	3
<ul style="list-style-type: none">• Any two of the above	2
<ul style="list-style-type: none">• Any one of the above	1

Question 17 (b)*Outcomes assessed: H11, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• States correct consequence of increased CO₂ levels in a cell• Gives the importance of this to the cell	2
<ul style="list-style-type: none">• States a correct consequence of increased CO₂ levels <p>OR</p> <ul style="list-style-type: none">• Indicates the importance of low CO₂ levels in the cell	1

Question 18*Outcomes assessed: H4, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Diagram depicting a correct example of change from a specific stable state• Identifies the gland/organ that initiates the response• Includes a feedback showing return to stable state• Identifies body responses required to effect change	4
<ul style="list-style-type: none">• Diagram depicting a change from a specific stable state plus any two from above components	3
<ul style="list-style-type: none">• Diagram depicting a change from a specific stable state plus any one of the above components	2
<ul style="list-style-type: none">• Any correct example of homeostasis or any one of the above components	1

**Question 19***Outcomes assessed: H4, H7, H10***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly identifies at least 2 mechanisms of inheritance• Using one of the identified mechanisms, explains how antibiotic treated bacteria develops resistance	3
<ul style="list-style-type: none">• Identifies one mechanism of inheritance that correctly explains how antibiotic-treated bacteria have developed resistance to antibiotics OR	2
<ul style="list-style-type: none">• Identifies two mechanisms of inheritance correctly	
<ul style="list-style-type: none">• Correctly identifies one mechanism of inheritance	1

Question 20 (a)*Outcomes assessed: H6, H10***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correct identification of mutagenic radiation	1

Question 20 (b)*Outcomes assessed: H6, H10***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly describes evidence relating the selected radiation to its mutagenic effect	2
<ul style="list-style-type: none">• Correctly identifies consequence/observable effect of selected radiation	1

Question 21 (a)*Outcomes assessed: H3, H5, H6***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly identifies one technology that can be used to establish evolutionary relationships	1

Question 21 (b)*Outcomes assessed: H3, H5, H6***MARKING GUIDELINES**

Criteria	Marks
• Correctly explains how the data revealed by the technology may be used to establish evolutionary relationships	2
• Correctly identifies the data revealed by the technology without indicating how this can be used to measure relationships	1

Question 22*Outcomes assessed: H4***MARKING GUIDELINES**

Criteria	Marks
• Identification of at least two relevant ethical issues associated with genetically modifying animals • Provides an argument for and/or against genetically modifying animals	4
• Identification of at least two examples of relevant ethical issues associated with genetically modifying animals • Provides an argument for or against genetically modifying animals	3
• Provides one relevant ethical issue and • Provides an argument for and/or against genetically modifying organisms OR • Lists at least two relevant ethical issues associated with genetically modifying organisms	2
• Identifies one relevant ethical issue arising with genetically modified organisms OR provides an argument	1

Question 23 (a)*Outcomes assessed: H4, H7***MARKING GUIDELINES**

Criteria	Marks
• Correct definition given	1

**Question 23 (b)***Outcomes assessed: H4, H7***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Gives at least two correctly outlined methods of internal salt balance in estuarine plants	2
<ul style="list-style-type: none">Gives one correctly outlined method of internal salt balance in estuarine plants OR <ul style="list-style-type: none">Gives two correctly identified methods only	1

Question 24 (a)*Outcomes assessed: H5***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Describes the main feature of Rosalind Franklin's workLinks this to the findings of Watson and Crick	2
<ul style="list-style-type: none">Describes the main features of Rosalind Franklin's work. No correct link provided	1

Question 24 (b)*Outcomes assessed: H5***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Provides a description of at least two relevant and correct genetic technologiesMakes a judgement on the impact of the discovery of DNA structure on genetic technology	5–6
<ul style="list-style-type: none">Makes a judgement on the impact of the discovery of DNA structure on genetic technologyDescribes two relevant genetic technologies correctly	3–4
<ul style="list-style-type: none">Two correctly named genetic technologies OR <ul style="list-style-type: none">One correctly named and described genetic technology OR <ul style="list-style-type: none">Correct statement regarding the impact of the discovery of DNA with an example stated	2
<ul style="list-style-type: none">One correctly named genetic technology OR <ul style="list-style-type: none">Correct statement regarding the impact of the discovery of DNA	1

**Question 25***Outcomes assessed: H11, H12, H13, H14.1***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Identifies at least two limitations in using model(s)Provides two reasons for the use of model(s)	4
<ul style="list-style-type: none">Identifies two limitations and provides one reason for using model(s) OR <ul style="list-style-type: none">Provides two points for using model(s) and one against	3
<ul style="list-style-type: none">Identifies one limitation but has made one point for use of model(s) OR <ul style="list-style-type: none">Identifies two limitations in using model(s) OR <ul style="list-style-type: none">Provides two points for using model(s)	2
<ul style="list-style-type: none">Identifies one limitation OR <ul style="list-style-type: none">One point for use	1

Question 26*Outcomes assessed: H9, H10***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Correctly defines the terms allele and geneMakes clear the difference between the terms allele and geneProvides correct example	3
<ul style="list-style-type: none">Any two from above	2
<ul style="list-style-type: none">Any one from above	1

Question 27*Outcomes assessed: H6, H8***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Provides a correct definition for both terms 'health' and 'disease'Identifies difficulties in defining both terms	4
<ul style="list-style-type: none">Provides a correct definition for both terms 'health' and 'disease'States only one possible difficulty in defining the terms	3
<ul style="list-style-type: none">Provides correct definition of either term 'health' or 'disease'State a possible difficulty in defining the term OR <ul style="list-style-type: none">Provides two difficulties in defining terms 'health' and 'disease'	2
<ul style="list-style-type: none">Provides one difficulty in defining terms 'health' and 'disease' OR <ul style="list-style-type: none">Provide a correct definition for either term 'health' or 'disease'	1

Question 28*Outcomes assessed: H3, H4***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Outline of secondary immune response and immaturity of immune responseLinks both to repeated inoculation at early age to immaturity of immune response	4
<ul style="list-style-type: none">Outline of secondary immune response and immaturity of immune responseLinks one to repeated inoculation at early age	3
<ul style="list-style-type: none">Outline of secondary immune response and immaturity of immune responseNo links provided	2
<ul style="list-style-type: none">Recognises that immunity is an acquired process	1

**Question 29***Outcomes assessed: H1, H11, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Collection of a large quantity of relevant data such as diet, habit of affected and non affected people, environmental conditions• Statistical analysis of data• Appropriate representation/sampling of population	7–8
<ul style="list-style-type: none">• Collection of a range of relevant data• Attempt description of data use• Appropriate representation/sampling of population	5–6
<ul style="list-style-type: none">• At least two relevant factors identified for data collection• Relevant identification of population groups to be studied	3–4
<ul style="list-style-type: none">• At least two relevant factors identified for data collection OR <ul style="list-style-type: none">• Relevant population groups identified for sampling	1–2

Question 30 (a) (1)*Outcomes assessed: H4, H8***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly identified receptor	1

Question 30 (a) (2)*Outcomes assessed: H4, H8***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly identified receptor	1

Question 30 (a) (3)*Outcomes assessed: H4, H8***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly identified sense receptor	1

**Question 30 (b) (i)***Outcomes assessed: H4, H8***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Appropriate possible cause correct• Link to scenario	2
<ul style="list-style-type: none">• Appropriate possible cause without link to scenario	1

Question 30 (b) (ii)*Outcomes assessed: H8, H13***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly identifies 2 other aspects of vision affected• Relates the effects to the loss of vision in one eye	3
<ul style="list-style-type: none">• Correctly identifies 2 other aspects of vision affected only• OR• Correctly identifies 1 aspect and relates the effect to the loss of vision in one eye	2
<ul style="list-style-type: none">• Correctly identifies one aspect of vision affected	1

Question 30 (c) (i)*Outcomes assessed: H4, H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly identifies animal	1

**Question 30 (c) (ii)***Outcomes assessed: H4***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Identifies at least two correct reasons for differences in sound frequency detectionElaboration of each difference	4
<ul style="list-style-type: none">Identifies at least two correct reasons for differences in sound frequency detectionElaboration of ONE difference	3
<ul style="list-style-type: none">Identifies one correct reason for differences in sound frequency detectionElaboration of difference OR <ul style="list-style-type: none">Two correct reasons for differences identified only	2
<ul style="list-style-type: none">One correct reason identified	1

Question 30 (d) (i)*Outcomes assessed: H12***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Describes the processing of information in detail AND <ul style="list-style-type: none">Describes the analysis of information in detail	4
<ul style="list-style-type: none">Describes the processing of information in detail (more than one method) OR <ul style="list-style-type: none">Describes the analysis of information in detail (more than one method)	3
<ul style="list-style-type: none">States two methods of processing/analysing information OR <ul style="list-style-type: none">Describes up to two methods in detail	2
<ul style="list-style-type: none">States one method of processing information OR <ul style="list-style-type: none">States one method of analysing information	1

Question 30 (d) (ii)*Outcomes assessed: H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">One correct method that could be used to determine reliability of information given	1

**Question 30 (e)***Outcomes assessed: H1, H3, H4, H11, H16***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correct extensive description of identified technologies used to deal with both hearing and vision deterioration• Analyses the limitations of the technologies and suggests advantages in the use of the technologies• Makes a judgement on the basis of the given criteria	7
<ul style="list-style-type: none">• Correct extensive description of identified technologies used to deal with both hearing and vision deterioration• Provides at least one limitation of the technologies and suggests at least one advantage in the use of the technology• Makes a judgement on the basis of given criteria	5–6
<ul style="list-style-type: none">• Correctly describes identified technologies used to deal with both hearing and vision deterioration• Provides at least one limitation and suggests one advantage in the use of the technology OR <ul style="list-style-type: none">• Makes a judgement on the basis of given criteria	3–4
<ul style="list-style-type: none">• Correctly describes identified technology used to deal with hearing and/or vision deterioration OR <ul style="list-style-type: none">• Correctly identifies technology used to deal with either hearing or vision deterioration and states its limitation/advantage	2
<ul style="list-style-type: none">• Correctly identifies technology used to deal with either hearing or vision deterioration OR <ul style="list-style-type: none">• Provides a limitation/advantage for either hearing or vision technologies	1

Question 31 (a) (i)*Outcomes assessed: H10***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Suitable definition for artificial selection	1

**Question 31 (a) (ii)***Outcomes assessed: H10***MARKING GUIDELINES**

Criteria	Marks
• Correctly identifies one change that has occurred in a named animal species or plant species	2
• Correctly identifies one change	1

Question 31 (b) (i)*Outcomes assessed: H9, H10***MARKING GUIDELINES**

Criteria	Marks
• Outlines the fermentation processes in bread or alcohol production	2
• Partially outlines some of the fermentation processes involved in bread or alcohol production	1

Question 31 (b) (ii)*Outcomes assessed: H9, H10***MARKING GUIDELINES**

Criteria	Marks
• Explains at least two correct ways in which changes in scientific knowledge have modified the traditional methods of bread/alcohol production • Links the changes to scientific knowledge	3
• Explains one correct way technology has changed the traditional methods of bread/alcohol production and • Links the change to current scientific knowledge	2
• Identifies one correct technology that has changed the traditional methods of bread/alcohol production	1

Question 31 (c) (i)*Outcomes assessed: H3, H14***MARKING GUIDELINES**

Criteria	Marks
• Correctly explains that enzyme <i>A</i> has suitable activity at 37°C and pH of 7.5	2
• Correctly identifies enzyme <i>A</i>	1

**Question 31 (c) (ii)***Outcomes assessed: H3, H6***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• One enzyme is correctly identified• Complete description of its function is given	3
<ul style="list-style-type: none">• One enzyme is correctly identified• General outline of its function given	2
<ul style="list-style-type: none">• Enzyme is correctly identified OR <ul style="list-style-type: none">• Correct function described	1

Question 31 (d) (i)*Outcomes assessed: H12***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Describes the processing of information in detail AND <ul style="list-style-type: none">• Describes the analysis of information in detail	4
<ul style="list-style-type: none">• Describes the processing of information in detail OR <ul style="list-style-type: none">• Describes the analysis of information in detail	3
<ul style="list-style-type: none">• States two methods of processing/analysing information OR <ul style="list-style-type: none">• Describes up to two methods in detail	2
<ul style="list-style-type: none">• States one method of processing information OR <ul style="list-style-type: none">• States one method of analysing information	1

Question 31 (d) (ii)*Outcomes assessed: H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• One correct method that could be given to determine reliability of information given	1

**Question 31 (e)***Outcomes assessed: H4***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Extensive description of the correct uses of fermentation in society today• Analyses the benefits and disadvantages of fermentation products to society in order to make a judgement on the basis of the given criteria	7
<ul style="list-style-type: none">• Extensive description of the correct uses of fermentation products in society given• Description of the advantages and disadvantages of such products given.• Attempts to make judgement on the basis of given criteria	5–6
<ul style="list-style-type: none">• Describes at least two correct uses of fermentation products in society• Describes benefits or disadvantages	3–4
<ul style="list-style-type: none">• States two correct uses of fermentation products in society OR	2
<ul style="list-style-type: none">• States one correct use with relevant advantage/disadvantage	
<ul style="list-style-type: none">• States one correct use of fermentation	1

Question 32 (a) (i)*Outcomes assessed: H9***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Provides/states correct definition	1

Question 32 (a) (ii)*Outcomes assessed: H9***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Outlines at least two correct steps in the production of recombinant DNA	2
<ul style="list-style-type: none">• Outlines one correct step in the production of recombinant DNA• OR• Identifies two correct steps	1

Question 32 (b) (i)*Outcomes assessed: H7***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Outlines at least two correct statements about the benefits of the Human Genome Project	2
<ul style="list-style-type: none">• Outlines one correct statement relating to the benefits of the Human Genome Project OR <ul style="list-style-type: none">• Lists two benefits	1

Question 32 (b) (ii)*Outcomes assessed: H7***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Fully describes how gene therapy is used to treat a named disease, or named cancer or AIDS and gives points for and/or against gene therapy of such diseases OR <ul style="list-style-type: none">• Provides a full discussion with at least three correct points relating to management of the named disease	3
<ul style="list-style-type: none">• Fully describes how gene therapy is used to treat a named disease, or named cancer or AIDS and gives a point for OR against OR <ul style="list-style-type: none">• Provides a discussion with at least two correct points relating to management of the named disease	2
<ul style="list-style-type: none">• Describes how gene therapy can be used to treat a named disease, or named cancer or AIDS OR <ul style="list-style-type: none">• Provides at least one relevant point relating to gene therapy management	1

Question 32 (c) (i)*Outcomes assessed: H9***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly identifies the fact that no males can be excluded	1

**Question 32 (c) (ii)***Outcomes assessed: H9***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Correctly identifies that male 1 and 2 can be excluded as they have no matching DNA fragments	1

Question 32 (c) (iii)*Outcomes assessed: H9, H12***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Compares the resulting probabilities of blood groups and genetic finger printsNominates DNA finger printing as the more accurate	3
<ul style="list-style-type: none">Gives a general reason why DNA finger printing is better than Blood grouping	2
<ul style="list-style-type: none">States that DNA finger printing is more accurate	1

Question 32 (d) (i)*Outcomes assessed: H12***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Describes the processing of information in detail AND <ul style="list-style-type: none">Describes the analysis of information in detail	4
<ul style="list-style-type: none">Describes the processing of information in detail (more than one method) OR <ul style="list-style-type: none">Describes the analysis of information in detail (more than one method)	3
<ul style="list-style-type: none">States two methods of processing/analysing information OR <ul style="list-style-type: none">Describes up to two methods in detail	2
<ul style="list-style-type: none">States one method of processing information OR <ul style="list-style-type: none">States one method of analysing information	1

**Question 32 (d) (ii)***Outcomes assessed: H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">One correct method that could be used to determine reliability of information given	1

Question 32 (e)*Outcomes assessed: H4, H10***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Implies understanding of what is meant by gene cloningDescribes an advantage and disadvantage of the cloning procedureDiscusses advantages and disadvantages of the application of cloned genesMakes a judgement on whether gene cloning should be continued in light of benefits to humans	7
<ul style="list-style-type: none">Implies understanding of what is meant by gene cloningMakes a link between the cloning process and the final productDiscusses advantages and disadvantages of the application of cloned genesMakes a judgement on whether gene cloning should be continued in the light of benefits to humans	5–6
<ul style="list-style-type: none">Discusses advantages and disadvantages of the applications of cloned genesMakes a judgement on whether gene cloning should be continued in the light of benefits to humans	3–4
<ul style="list-style-type: none">Discusses advantages and disadvantages of the applications of cloned genes <p>OR</p> <ul style="list-style-type: none">Shows an understanding of what is meant by gene cloning	1–2

Question 33 (a) (1)*Outcomes assessed: H6, H7***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Primate	1

**Question 33 (a) (2)***Outcomes assessed: H6, H7***MARKING GUIDELINES**

Criteria	Marks
• Family	1

Question 33 (a) (3)*Outcomes assessed: H6, H7***MARKING GUIDELINES**

Criteria	Marks
• Correct distinguishing characteristics	1

Question 33 (b) (i)*Outcomes assessed: H3, H6, H9***MARKING GUIDELINES**

Criteria	Marks
• States correctly the differences between absolute and relative dates	2
• Defines either relative dates or absolute dates	1

Question 33 (b) (ii)*Outcomes assessed: H3, H6, H9***MARKING GUIDELINES**

Criteria	Marks
• Correctly identifies two reasons for uncertainty • Correctly relates the reasons back to the speculative family tree	3
• Correctly identifies one reason for uncertainty • Correctly relates the reason back to the speculative family tree OR • Only correctly identifies two reasons without relating back to the speculative family tree	2
• Correctly identifies one reason for uncertainty	1

Question 33 (c) (i)*Outcomes assessed: H6, H9, H14***MARKING GUIDELINES**

Criteria	Marks
• Correct plausible explanation	2
• Partially correct/incomplete explanation	1

Question 33 (c) (ii)*Outcomes assessed: H6, H9***MARKING GUIDELINES**

Criteria	Marks
• Describes migration patterns • Describes population of time factors • Relates these to each other	3
• Identifies migration patterns AND • Identifies time factors	2
• Identifies either migration patterns or population time factors	1

Question 33 (d) (i)*Outcomes assessed: H12***MARKING GUIDELINES**

Criteria	Marks
• Describes the processing of information in detail AND • Describes the analysis of information in detail	4
• Describes the processing of information in detail OR • Describes the analysis of information in detail	3
• States two methods of processing/analysing information OR • Describes up to two methods in detail	2
• States one method of processing information OR • States one method of analysing information	1

**Question 33 (d) (ii)***Outcomes assessed: H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">One correct method that could be used to determine reliability of information given	1

Question 33 (e)*Outcomes assessed: H1, H2, H4***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Describes in detail one modelProvides detailed, relevant evidence for model selectedMakes a judgement of validity of named model based on evidence provided	6–7
<ul style="list-style-type: none">Describes one model in some detailProvides relevant evidenceAttempts to make a judgement on the usefulness of the model	4–5
<ul style="list-style-type: none">Describes one model and provides limited detailProvides relevant examples of evidence OR <ul style="list-style-type: none">Makes a judgement	2–3
<ul style="list-style-type: none">Describes one modelORProvides relevant examples of evidence	1

Question 34 (a) (i)*Outcomes assessed: H6***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">Correct identification of structure <i>A</i>	1

**Question 34 (a) (ii)***Outcomes assessed: H6***MARKING GUIDELINES**

Criteria	Marks
• Two functions for B stated	2
• One function for B stated	1

Question 34 (b) (i)*Outcomes assessed: H6***MARKING GUIDELINES**

Criteria	Marks
• Correct identification of the reactants	1

Question 34 (b) (ii)*Outcomes assessed: H6***MARKING GUIDELINES**

Criteria	Marks
• Correctly describes the Calvin cycle, possibly using a diagram, showing the role of NADP and NADPH in specific parts of the cycle	4
• Explains the role of NADPH in hydrogen ion (H^+) transfer	
• Correctly identifies the role of NADP and NADPH in the Calvin cycle	3
• Attempts to explain the hydrogen ion (H^+) transfer in the Calvin cycle	
• Correctly identifies how or where hydrogen ion (H^+) is transferred in the Calvin cycle	2
• Identifies a relevant isolated fact about NADPH in relation to the Calvin cycle	1

Question 34 (c) (i)*Outcomes assessed: H6***MARKING GUIDELINES**

Criteria	Marks
• Correctly explains van Helmont's explanation in terms of the sources of the plants' increased weight	2
• States one component of van Helmont explanation	1

Question 34 (c) (ii)*Outcomes assessed: H12, H14***MARKING GUIDELINES**

Criteria	Marks
• Correctly explains the use of radioactive oxygen to deduce the origin of the oxygen in at least two of the products of photosynthesis	3
• Correctly relates the use of radioactive oxygen to one of the products of photosynthesis	2
• Correctly states the role of a radioactive tracer	1

Question 34 (d) (i)*Outcomes assessed: H12***MARKING GUIDELINES**

Criteria	Marks
• Describes the processing of information in detail AND • Describes the analysis of information in detail	4
• Describes the processing of information in detail OR • Describes the analysis of information in detail	3
• States two methods of processing/analysing information OR • Describes up to two methods in detail	2
• States one method of processing information OR • States one method of analysing information	1

Question 34 (d) (ii)*Outcomes assessed: H14***MARKING GUIDELINES**

Criteria	Marks
• One correct method that could be used to determine reliability of information given	1

**Question 34 (e)***Outcomes assessed: H1, H2, H3, H4, H6, H8, H11, H13, H16***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none">• Correctly identifies two non-renewable resources that can be replaced via products of photosynthesis• Correctly explains how photosynthesis can be used to produce the alternative products• Makes a judgement regarding the use of the photosynthetic product alternative with examples	7
<ul style="list-style-type: none">• Correctly identifies two non-renewable resources that can be replaced via products of photosynthesis• Correctly outlines how photosynthesis can be used to produce the alternative products• Makes a judgement regarding the use of the photosynthetic product alternative	5–6
<ul style="list-style-type: none">• Correctly identifies at least one non-renewable resource that can be replaced via products of photosynthesis• Correct but limited understanding of the production of the alternative product through photosynthesis• Attempts to make a judgement regarding the use of the photosynthetic product alternative	3–4
<ul style="list-style-type: none">• Correctly identifies at least one non-renewable resource that can be replaced via products of photosynthesis <p>OR</p> <ul style="list-style-type: none">• Attempts to make a judgement regarding the use of the photosynthetic product alternative	1–2