

**2005 HSC Notes from  
the Marking Centre  
Biology**

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# 2005 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 2005 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.

This document should be read along with the relevant syllabus, the 2005 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 2005, 13217 candidates attempted the Biology examination. The most popular electives were Communication (58%) and Genetics: The Code Broken? (20%).

Teachers and candidates should be aware that examiners may write 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, including the Prescribed Focus Areas. 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. It is important to understand that the Preliminary HSC course is assumed knowledge for the HSC course.

In 2005, at least one question in Section 1 Part B focused on the mandatory skills content in Module 9.1. Candidates who had actively planned and performed practical experiences clearly demonstrated a deeper knowledge and understanding of the content described in this module. There was evidence that some candidates had a very poor knowledge of basic definitions specific to terminology associated with the course.

Overall, the candidate's responses were appropriate and indicated a level of understanding of Biology concepts, appropriate for most HSC candidates. Candidates need to be reminded that the answer space provided and the marks allocated are guides to the maximum length of response required. Similarly, the key word used in the question gives an indication of the depth of the required response. Candidates should use examination time to analyse the question and plan responses carefully, working within that framework to produce clear and concise responses. This may include the use of dot points, diagrams and/or tables, and avoids internal contradictions. This is particularly so in holistic questions which need to be logical and well structured.

Better responses indicate that candidates are following the instructions provided on the examination paper. In these responses, candidates:

- show all working where required by the question
- do not repeat the question as part of the response
- look at the structure of the whole question and note that in some questions the parts follow from each other ie responses in part (a) lead to the required response in part (b) etc

- use appropriate equipment, for example, pencils and a ruler to draw diagrams and graphs. (A clear plastic ruler would aid candidates to plot points that are further from the axes and rule straight lines of best fit.)

The option question is divided into a number of parts: candidates should clearly label each part of the question when writing in their answer booklets. In part (c), many candidates wrote a lot of information that was not relevant to the question. Some responses show evidence of rote learning an anticipated answer based on a single source. These did not address the syllabus content and/or outcomes being assessed and hence did not score full marks. Some candidates are responding to more than one option question: candidates are strongly advised to answer the option they have studied in class.

## Section I – Core

### Part A – Multiple choice

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

Question	Correct Response
9	D
10	C
11	B
12	D
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, and that marks are awarded for quality, not quantity; some candidates exceeded the space provided.

### **Specific Comments**

#### **Question 16**

- (a) The better responses included a correct definition of a pathogen. However, a significant number of candidates were unable to do this.
- (b) Most responses provided correct distinguishing characteristics and features of the two microorganisms.

#### **Question 17**

This question was generally well answered, with the majority of candidates demonstrating a sound understanding of the concept of feedback.

#### **Question 18**

The better responses provided the main features of transcription and translation, using correct terminology. Weaker responses confused the processes with each other, or with other processes like translocation, transpiration and transportation.

#### **Question 19**

The better responses demonstrated a good basic understanding of their named disease by correctly describing all features in the table.

#### **Question 20**

The better responses related cause and effect correctly for each organism. Weaker responses simply stated a cause or an effect. Some candidates did not understand the concept of osmosis.

#### **Question 21**

- (a) The majority of responses correctly identified why excess carbon dioxide needs to be removed from the blood.
- (b) Most candidates stated at least one correct form in which carbon dioxide is transported in blood. In the better responses, two forms were stated.
- (c) Most candidates identified some features of an experimental method. A significant number of candidates confused reliability with accuracy or validity.

### Question 22

This question was generally well answered, with the majority of candidates able to identify issues and provide points for and/or against tagging.

### Question 23

- (a) This question was generally well answered.
- (b) This question was generally well answered.
- (c) In the better responses, cause and effect were related to show how crossing over affects the inheritance of genes. They also correctly identified where crossing over occurs.

### Question 24

- (a) Most candidates represented the written description of the family by constructing a pedigree of some type. The better responses included a key, used conventional symbols and demonstrated an understanding of sex-linkage.
- (b) In the better responses, candidates made a correct prediction from their pedigree and supported their prediction.

### Question 25

This question assessed Module 9.1 skills content and was generally well answered.

- (a) Most candidates were able to identify an appropriate method. A significant number of candidates named the type of data that could be collected without naming the method required to collect it.
- (b) Most candidates were able to state another valid piece of information.
- (c) In the better responses candidates clearly made judgements about the impacts which would result from the alternative strategies. A significant number of candidates did not support the claims they made, while some candidates simply identified impacts without making a judgement.

### Question 26

In the better responses, candidates demonstrated a clear understanding of the adaptations of mangroves and related them to environmental conditions.

A significant number of candidates misinterpreted the term 'relative abundance' on the graph as referring to water, while others misinterpreted the terms 'high water mark' and 'low water mark' as meaning areas of high and low water availability.

### Question 27

In the better responses, candidates explained the relationship between high mutation rates in the virus and the impact on the human immune response, and linked them to appropriate implications for both survival of the virus and humans.

The majority of candidates demonstrated a sound knowledge of the immune response. A considerable number of candidates confused terms such as antibodies, antigens and antibiotics, and many thought that antibiotics were used against viruses.

## Section II – Options

### Question 28 – Communication

- (a) (i) Most candidates were able to correctly identify the retina.
- (ii) Better responses used clear, well-labelled diagrams to show variation in the curvature of the lens, the condition of the ciliary muscles and suspensory ligaments and the refraction of the rays onto the retina for both near and far objects.
- (b) (i) The better responses gave characteristics and features for both conditions.
- (ii) Better responses clearly identified similarities and/or differences between both technologies, and often presented the response in table form.
- (c) Candidates were generally able to provide benefits and limitations of the two technologies. However, in a significant number of responses the judgement about the technologies was either limited or absent. Better responses often used a table to present points for and against the technologies and included clear examples to qualify the judgements.
- (d) (i) Most candidates were able to identify from the diagram two differences between the neurones.
- (ii) Most candidates were able to identify a benefit or limitation of the use of prepared slides or micrographs. In the better responses candidates made a clear judgement of the value of the use of slides or micrographs in gathering information about the structure of neurones.
- (iii) Many responses sketched in general terms the concept of ‘threshold’. Better responses were able to make the relationship between stimulus and action potential evident.

### Question 29 – Biotechnology

- (a) (i) Most candidates were able to identify carbon dioxide as the second product.
- (ii) In the better responses, candidates included specific information about the features and characteristics of a modern fermentation process.
- (b) (i) Better responses clearly stated the meaning of ‘recombinant DNA technology’ and provided an example. A significant number of candidates were unable to provide an example.
- (ii) Most candidates were able to give characteristics and features of these processes. Better responses used a table to clearly identify similarities and/or differences.
- (c) Candidates were generally able to provide benefits and limitations for selected applications. However, in a significant number of responses the judgement was either absent or limited to a generalised judgement about biotechnology rather than to the case studies.

- (d) (i) This part of the question was generally well answered. Candidates are reminded that a supporting statement is required for a justification.
- (ii) Better responses provided detailed reasons for collecting a DNA sample from the victim.
- (iii) Many high quality responses included PCR techniques in amplifying small samples and the separation of fragments using electrophoresis.

**Question 30 – Genetics: The Code Broken?**

- (a) (i) This part of the question was generally well answered. A number of candidates confused the relative positions of phosphate and sugar molecules.
- (ii) This part of the question was generally well answered.
- (b) (i) The majority of candidates correctly identified both the number of chromosomes and the chromosomal disorder as trisomy. Some candidates incorrectly counted chromosomal pairs as single chromosomes.
- (ii) In the better responses, candidates clearly described the location of somatic and germ line mutations and compared the impact of each on the gene pool of a species.
- (c) Candidates were generally able to list benefits and limitations of the Human Genome Project. However, in a significant number of responses the judgement was either absent or limited to a generalised judgement of the project. Better responses provided points for and against the benefits and limitations and used specific examples to qualify the judgements.
- (d) (i) This part of the question was generally well answered.
- (ii) Better responses recognised gene linkage and provided both phenotypic and genotypic ratios.
- (iii) Better responses related the use of a test cross to finding the percentage of recombinant types. Some candidates confused cross-breeding with hybridisation and finding the relative position of genes with finding the exact location of genes. Candidates are reminded that diagrams can add value to the quality of a response.

**Question 31 – The Human Story**

- (a) (i) A significant number of candidates were unable to name karyotype analysis.
- (ii) (ii) This part of the question was generally well answered.
- (b) (i) This part of the question was generally well answered.
- (ii) Better responses identified the issues and developed points for and/or against the difficulty of interpreting the past using only fossil records. Weaker responses tended to list some of the difficulties.

- (c) In the better responses, candidates clearly linked the effects of population mobility, modern medicine and genetic engineering on human evolution, and gave an indication of possible future trends.
- (d)
  - (i) Most candidates correctly outlined an absolute dating technique. In the better responses, candidates were also able to clearly show the differences between relative and absolute dating.
  - (ii) This part of the question was generally well answered.
  - (iii) The better responses referred to the stimulus material to show how the models were similar or different.

### **Question 32 – Biochemistry**

- (a)
  - (i) A significant number of candidates incorrectly named the pigment.
  - (ii) Better responses identified the link between the experimental set-up and photosynthesis and used this to name three pieces of information obtained from the experiments.
- (b)
  - (i) Most candidates were able to use the data to recognise the changes in oxygen production between plant X and Y. In the better responses, candidates related these differences to microscopic structural features such as size/number of chloroplasts.
  - (ii) The better responses identified the thylakoid membranes as the site of the light-dependent reactions and the stroma for the Calvin cycle, both located in the chloroplasts.
- (c) Candidates were generally able to identify issues and provide points for and/or against the advantages and disadvantages of renewable resources, derived from biomass, being used to replace non-renewable resources. However, in a significant number of responses the judgement was either absent or limited to a generalised judgement rather than to the specific examples.
- (d)
  - (i) This part of the question was generally well answered.
  - (ii) The better responses summarised the steps of photosystem I and II into a simple linked flow diagram and showed where the products of these reactions moved on to further parts of the photosynthetic pathway.

# Biology

## 2005 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
<b>Section I Part A</b>			
1	1	9.2.2.21, 9.2.2.2.2	H6
2	1	9.3.4.3.5	H9
3	1	9.4.2.2.1, 9.4.6.2.2	H6
4	1	9.3.2.2.5, 9.3.3.2.2	H9
5	1	9.4.3.3.2	H6
6	1	9.4.6.1	H5
7	1	9.2.3.2.9, 9.2.3.3.7	H7, H14
8	1	9.4.2.3.2, 9.4.2.2.2	H8
9	1	9.2.1.3.2	H6, H12
10	1	9.3.3.2.3, 9.3.4.2.1	H9, H14
11	1	9.4.5.2.3	H6
12	1	9.2.3.2.4	H6, H14
13	1	9.2.2.3.2	H6, H12
14	1	9.3.3.2.6, 9.3.3.2.8	H9, H14
15	1	9.3.1.2.3	H10
<b>Section I Part B</b>			
16 (a)	1	9.4.2.2.3	H13
16 (b)	2	9.4.2.2.3,	H13
17	3	9.2.1.2.6, 9.2.1.2.5	H6
18	4	9.3.4.2.2/3, 9.3.4.3.1	H6, H13
19	4	9.4.3.3.3	H6, H12, H13
20	3	9.2.3.3.4	H6, H12, H14
21 (a)	1	9.2.2.2.5	H6
21 (b)	2	9.2.2.2.1	H6
21 (c)	5	9.2.2.3.1	H11, H12

Question	Marks	Content	Syllabus outcomes
22	4	9.4.7.3.3, 9.4.7.2.1, 9.4.7.3.2	H1, H4
23 (a)	1	9.3.3.3.1	H9, H12
23 (b)	1	9.3.3.3.1	H9, H12
23 (c)	3	9.3.3.3.1	H9
24 (a)	4	9.3.2.3.1	H13, H14
24 (b)	2	9.3.2.2.6	H14
25 (a)	1	9.1	H4, H11
25 (b)	2	9.1	H4, H11
25 (c)	5	9.1	H4, H10
26	4	9.2.3.2.8, 9.2.3.3.6	H7, H12, H14
27	8	9.3.4.2.4, 9.4.4.2.2, 9.4.5.3.1, 9.4.5.2.1	H6, H10
<b>Section II</b>			
<b>Question 28 — Communication</b>			
28 (a) (i)	1	9.5.2.3.1	H6
28 (a) (ii)	3	9.5.3.3.2	H6, H12
28 (b) (i)	2	9.5.3.2.5	H6, H14
28 (b) (ii)	4	9.5.3.3.3	H6, H12
28 (c)	7	9.5.6.3.3	H3, H5, H14
28 (d) (i)	2	9.5.7.3.1	H6, H14
28 (d) (ii)	3	9.5.7.3.1	H6, H14
28 (d) (iii)	3	9.5.7.3.1	H6, H14
<b>Section II</b>			
<b>Question 29 — Biotechnology</b>			
29 (a) (i)	1	9.6.2.2.1, 9.6.3.2.1	H8
29 (a) (ii)	3	9.6.3.3.1, 9.6.3.3.2	H8, H12
29 (b) (i)	2	9.6.5.2.1, 9.6.5.2.2	H7
29 (b) (ii)	4	9.6.1.3.1, 9.6.1.2.3, 9.6.5.3.3	H7, H14
29 (c)	7	9.6.6.2.2, 9.6.6.2.3, 9.6.6.2.4, 9.6.6.3.1	H5, H14
29 (d) (i)	2	9.6.6.2.1	H6, H12, H14
29 (d) (ii)	3	9.6.6.2.1	H6, H14

Question	Marks	Content	Syllabus outcomes
29 (d) (iii)	3	9.6.6.2.1	H6, H14
<b>Section II</b>			
<b>Question 30 — Genetics: The Code Broken?</b>			
30 (a) (i)	2	9.7.1.3.1	H9, H14
30 (a) (ii)	2	9.7.1.3.1	H9, H14
30 (b) (i)	2	9.7.6.2.1	H9, H14
30 (b) (ii)	4	9.7.6.2.4	H9, H14
30 (c)	7	9.7.4.2.1, 9.7.4.2.2	H3, H5
30 (d) (i)	1	9.7.3.2.2	H9, H14
30 (d) (ii)	3	9.7.2.3, 9.7.3.3.1	H9, H13, H14
30 (d) (iii)	4	9.7.3.3.4	H6, H9, H14
<b>Section II</b>			
<b>Question 31 — The Human Story</b>			
31 (a) (i)	1	9.8.2.3.1	H10, H14
31 (a) (ii)	3	9.8.2.3.1	H10, H14
31 (b) (i)	2	9.8.1.2.3	H10
31 (b) (ii)	4	9.8.2.2.5	H10
31 (c)	7	9.8.6.1	H5
31 (d) (i)	3	9.8.2.2.3	H10, H14
31 (d) (ii)	2	9.8.4.2.1	H10, H14
31 (d) (iii)	3	9.8.3.3.3	H10, H14
<b>Section II</b>			
<b>Question 32 — Biochemistry</b>			
32 (a) (i)	1	9.9.2.2.1, 9.9.3.3.4	H6
32 (a) (ii)	3	9.4.3	H6, H14
32 (b) (i)	3	9.9.8.3.1, 9.9.8.2.2	H6, H14
32 (b) (ii)	3	9.9.8.3.2	H6
32 (c)	7	(9.9.1)	H3, H5
32 (d) (i)	3	9.9.3.3.4	H6, H14
32 (d) (ii)	5	9.9.4.2.5, 9.9.4.3.2	H6, H14

## 2005 HSC Biology Marking Guidelines

### Section I, Part B

#### Question 16 (a)

*Outcomes assessed: H13*

#### MARKING GUIDELINES

Criteria	Marks
• Correct definition of pathogen	1

#### Question 16 (b)

*Outcomes assessed: H13*

#### MARKING GUIDELINES

Criteria	Marks
• Characteristics for each organism that distinguishes them	2
• One characteristic of one of the organisms	1

**Question 17***Outcomes assessed: H6***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>Identifies the main features of a role of the nervous system using an example</li><li>Includes concepts of detection and response</li></ul>	3
<ul style="list-style-type: none"><li>Identifies a role of the nervous system using an example</li></ul>	2
<ul style="list-style-type: none"><li>Makes a correct statement about the nervous system</li></ul> OR <ul style="list-style-type: none"><li>States an example</li></ul>	1

**Question 18***Outcomes assessed: H6, H13***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>Names TWO processes correctly and indicates main features of the processes</li></ul>	4
<ul style="list-style-type: none"><li>Names TWO processes correctly and indicates main feature of ONE process</li></ul> OR <ul style="list-style-type: none"><li>Indicates main features of BOTH processes without naming</li></ul>	3
<ul style="list-style-type: none"><li>Names ONE process correctly and indicates main feature of named process</li></ul> OR <ul style="list-style-type: none"><li>ONE correct name and ONE correct function (not linked)</li></ul> OR <ul style="list-style-type: none"><li>TWO correct outlines with correct names but in wrong position</li></ul> OR <ul style="list-style-type: none"><li>TWO processes correctly named or outlined</li></ul>	2
<ul style="list-style-type: none"><li>ONE process correctly named</li></ul> OR <ul style="list-style-type: none"><li>ONE correct outline with correct name but in wrong position</li></ul>	1

**Question 19***Outcomes assessed: H6, H12, H13***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
• Provides characteristics of ALL the features related to the named infectious disease	4
• Provides characteristics of SOME features related to the named infectious disease	2–3
• Provides a characteristic related to the named disease	1

**Question 20***Outcomes assessed: H6, H12, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
• Identifies, for each organism, cause and effect on urine output	3
• Identifies cause and effect for TWO organisms	2
• Identifies cause and effect for ONE organism OR • Makes a correct statement about water concentration in the relevant environment	1

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

<b>Criteria</b>	<b>Marks</b>
• Identifies a reason for the removal of carbon dioxide	1

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

<b>Criteria</b>	<b>Marks</b>
• States TWO forms of carbon dioxide	2
• States ONE form of carbon dioxide	1

**Question 21 (c)***Outcomes assessed: H11, H12***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
• Identifies the main features of the method for an appropriate investigation, stating appropriate variables and stating a method for checking reliability of data	4–5
• Identifies some of the main features of the investigation with reference to the variables or reliability	2–3
• Makes some correct statements relating to the method	1

**Question 22***Outcomes assessed: H1, H4***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
• Identifies the issues and describes logical points for and/or against the use of this strategy in controlling the spread of disease	4
• Explains the use of this strategy	2–3
• Outlines the use of this strategy	1

**Question 23 (a)***Outcomes assessed: H9, H12***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
• Correctly identifies characteristic	1

**Question 23 (b)***Outcomes assessed: H9, H12***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
• Identifies process	1

**Question 23 (c)**

*Outcomes assessed: H9*

**MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none"> <li>Identifies where crossing over occurs. Links cause and effect of crossing over</li> </ul>	3
<ul style="list-style-type: none"> <li>Identifies crossing over AND describes crossing over OR the effect of crossing over</li> </ul> OR <ul style="list-style-type: none"> <li>Describes crossing over AND the effect of crossing over</li> </ul>	2
<ul style="list-style-type: none"> <li>Identifies where crossing over occurs</li> </ul> OR <ul style="list-style-type: none"> <li>Describes crossing over</li> </ul> OR <ul style="list-style-type: none"> <li>Describes the effect of crossing over</li> </ul>	1

**Question 24 (a)**

*Outcomes assessed: H13, H14*

**MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none"> <li>Constructs pedigree correctly showing affected and unaffected members. Anne identified as a carrier</li> <li>Correct key included</li> </ul>	4
<ul style="list-style-type: none"> <li>Constructs pedigree with some errors</li> <li>Key incomplete</li> </ul>	2–3
<ul style="list-style-type: none"> <li>Constructs the framework of the pedigree</li> <li>No key</li> </ul>	1

**Question 24 (b)**

*Outcomes assessed: H14*

**MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none"> <li>Makes a prediction based on pedigree in part (a)</li> <li>Supports prediction with logical argument</li> </ul>	2
<ul style="list-style-type: none"> <li>Makes a correct statement from pedigree drawn</li> </ul>	1

**Question 25 (a)***Outcomes assessed: H4, H11***MARKING GUIDELINES**

Criteria	Marks
• Names appropriate method	1

**Question 25 (b)***Outcomes assessed: H4, H11***MARKING GUIDELINES**

Criteria	Marks
• States one valid/relevant piece of information directly applicable to the plague locust AND • Describes how it can be used to develop a method of control	2
• States one valid/relevant piece of information directly applicable to the plague locust	1

**Question 25 (c)***Outcomes assessed: H4, H10***MARKING GUIDELINES**

Criteria	Marks
• Assesses issues from BOTH strategies that relate to society and the environment based on the issues identified	5
• Discusses the impact of BOTH strategies on society AND the environment	4
• Identifies the impact of ONE strategy on society AND the environment OR • Identifies the impact of BOTH strategies on either society OR the environment	3
• Identifies the impact of ONE strategy on either society OR the environment	2
• States an impact of ONE strategy	1

**Question 26***Outcomes assessed: H7, H12, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>• Correctly identifies each mangrove species on the graph</li><li>• Gives reasons for the placement of BOTH species referring to the purpose of the specific adaptation of each species and relates this to the environmental conditions</li></ul>	4
<ul style="list-style-type: none"><li>• Correctly identifies each mangrove species on the graph</li><li>• Describes the purpose of each adaptation</li></ul> OR <ul style="list-style-type: none"><li>• Gives reasons for the placement of one species, referring to the purpose of the specific adaptation for that species, and relates this to the environmental conditions</li></ul>	3
<ul style="list-style-type: none"><li>• Correctly identifies each mangrove species on the graph</li><li>• Describes the purpose ONE adaptation</li></ul> OR <ul style="list-style-type: none"><li>• Describes two adaptations</li></ul>	2
<ul style="list-style-type: none"><li>• Correctly identifies each mangrove species</li></ul> OR <ul style="list-style-type: none"><li>• Describes one adaptation</li></ul>	1

**Question 27***Outcomes assessed: H6, H10***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>• Indicates the progression from one mutation to another</li><li>• Explains relationships between the TWO components including the immune response</li><li>• Explains appropriate implications on both survival of the virus and human health</li></ul>	7–8
<ul style="list-style-type: none"><li>• Describes relationships between the TWO components</li><li>• Describes appropriate implications on both survival of the virus AND human health</li></ul>	5–6
<ul style="list-style-type: none"><li>• Identifies a relationship between the components</li><li>• Identifies appropriate points that impact on virus survival AND/OR human health</li></ul>	3–4
<ul style="list-style-type: none"><li>• Identifies points appropriate to the theme</li></ul>	1–2

## Section II – Option

### Question 28 (a) (i)

*Outcomes assessed: H6*

#### MARKING GUIDELINES

Criteria	Marks
• Retina	1

### Question 28 (a) (ii)

*Outcomes assessed: H6, H12*

#### MARKING GUIDELINES

Criteria	Marks
• Draws TWO correct labelled diagrams	3
• Draws TWO diagrams with some labels	2
• Draws ONE correct diagram	1

### Question 28 (b) (i)

*Outcomes assessed: H6, H14*

#### MARKING GUIDELINES

Criteria	Marks
• Provides characteristics and features for both conditions	2
• Provides characteristics and features for ONE condition OR • Outlines both conditions	1

### Question 28 (b) (ii)

*Outcomes assessed: H6, H12*

#### MARKING GUIDELINES

Criteria	Marks
• Shows how BOTH technologies are similar or different using descriptions and/or examples	4
• Show how BOTH the technologies are similar or different by outlining these	2–3
• States one technology used for one condition	1

**Question 28 (c)***Outcomes assessed: H3, H5, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>• Discusses benefits and limitations about both technologies</li><li>• Provides a judgement about each technology based on the criteria used and uses examples in support</li></ul>	7
<ul style="list-style-type: none"><li>• Provides points for and against both technologies</li><li>• Provides a judgement</li><li>• Provides an example</li></ul>	5–6
<ul style="list-style-type: none"><li>• Outlines a benefit and disadvantage for both technologies. An example is given for both</li></ul>	3–4
<ul style="list-style-type: none"><li>• Identifies a benefit and/or disadvantage for a technology</li></ul>	1–2

**Question 28 (d) (i)***Outcomes assessed: H6, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>• Two pieces of information from the diagram</li></ul>	2
<ul style="list-style-type: none"><li>• One piece of information from the diagram</li></ul>	1

**Question 28 (d) (ii)***Outcomes assessed: H6, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>• Describes the value of a use of micrograph or prepared slide</li><li>• Makes a judgement about the use of these for developing our understanding of neurones</li></ul>	3
<ul style="list-style-type: none"><li>• Outlines the use of micrograph/slide and describes how these help us understand structure of neurones</li><li>• Makes a judgement</li></ul>	2
<ul style="list-style-type: none"><li>• States a use prepared slides/micrograph</li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• Makes a judgement</li></ul>	1

**Question 28 (d) (iii)***Outcomes assessed: H6, H14***MARKING GUIDELINES**

Criteria	Marks
• Relates cause and effect of action potential and provides supporting evidence of when a stimulus does not elicit a response	3
• Outlines an action potential and identifies a situation where a stimulus does not elicit a response	2
• Makes a correct statement about an action potential	1

**Question 29 (a) (i)***Outcomes assessed: H8***MARKING GUIDELINES**

Criteria	Marks
• Carbon dioxide	1

**Question 29 (a) (ii)***Outcomes assessed: H8, H12***MARKING GUIDELINES**

Criteria	Marks
• Provides features and characteristics of a named modern industrial fermentation process	3
• Outlines a modern fermentation process	2
• Names a modern fermentation process	1

**Question 29 (b) (i)***Outcomes assessed: H7***MARKING GUIDELINES**

Criteria	Marks
• States meaning of the term recombinant DNA technology • Gives an appropriate example	2
• Correctly defines the term recombinant DNA technology OR • Gives an appropriate example	1

**Question 29 (b) (ii)***Outcomes assessed: H7, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
• Describes TWO or more similarities and/or differences between artificial selection and recombinant DNA technologies	4
• Describes at least ONE similarity and/or difference between artificial selection and recombinant DNA technology	2–3
• Identifies ONE similarity or difference between artificial selection and recombinant DNA technology	1

**Question 29 (c)***Outcomes assessed: H5, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>• Identifies appropriate issues and describes both limitations and benefits with points relevant to particular applications relating to TWO of the areas of biotechnology</li><li>• Provides a judgement about each application based on the criteria used and uses examples in support</li></ul>	6–7
<ul style="list-style-type: none"><li>• Describes both limitations and benefits with points relevant to particular applications</li><li>• Provides a judgement</li></ul>	4–5
<ul style="list-style-type: none"><li>• Describes a particular application of biotechnology research</li><li>• Identifies limitations and benefits without links to the particular application</li></ul>	2–3
<ul style="list-style-type: none"><li>• Describes a particular application of biotechnology research</li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• Identifies some limitations or benefits with reference to a particular application</li></ul>	1

**Question 29 (d) (i)***Outcomes assessed: H6, H12, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
• Identifies suspect and gives reasons	2
• Identifies suspect and gives reason	1

**Question 29 (d) (ii)***Outcomes assessed: H6, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>• Provides reasons for the use of DNA profiles and the need to identify the victim's DNA in the evidence sample</li><li>• Provides reasons for the collection of DNA from both the victim and suspect(s)</li><li>• Link the DNA samples collected to eliminate the victim's DNA from the evidence sample</li></ul>	3
<ul style="list-style-type: none"><li>• Provides reasons for the collection of DNA from both the victim and suspect(s)</li></ul> <p>OR</p> <ul style="list-style-type: none"><li>• Gives a simple statement relating the victim's DNA and the DNA in the evidence sample</li></ul>	1–2

**Question 29 (d) (iii)***Outcomes assessed: H6, H14***MARKING GUIDELINES**

Criteria	Marks
• Identifies main features and/or the uses of DNA analysis in forensic cases	2–3
• Identifies a use of DNA analysis	1

**Question 30 (a) (i)***Outcomes assessed: H9, H14***MARKING GUIDELINES**

Criteria	Marks
• Identifies TWO parts	2
• Identifies ONE Part	1

**Question 30 (a) (ii)***Outcomes assessed: H9, H14***MARKING GUIDELINES**

Criteria	Marks
• States TWO reasons	2
• States ONE reason	1

**Question 30 (b) (i)***Outcomes assessed: H9, H14***MARKING GUIDELINES**

Criteria	Marks
• Both answers correct	2
• ONE answer correct	1

**Question 30 (b) (ii)***Outcomes assessed: H9, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>Identifies where each mutation occurs</li><li>Describes the effects of each in terms of the species/population showing differences and/or similarities</li></ul>	4
<ul style="list-style-type: none"><li>Identifies the cells where each mutation occurs</li><li>Describes the effect/ impact of one type of mutation on the species/population showing similarities and/or differences</li></ul>	2–3
<ul style="list-style-type: none"><li>Identifies in which cells one of the mutations occurs</li></ul>	1

**Question 30 (c)***Outcomes assessed: H3, H5***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>Identifies appropriate issues of both limitations and benefits with relevant points for/and or against</li><li>Makes a judgement based on the criteria addressed</li></ul>	6–7
<ul style="list-style-type: none"><li>Identifies appropriate issues of both limitations and benefits with relevant points for/and or against</li><li>Outlines links with relevant examples</li><li>Provides a judgement</li></ul>	4–5
<ul style="list-style-type: none"><li>Identifies a benefit and issues associated, using examples</li></ul> <p>OR</p> <ul style="list-style-type: none"><li>Identifies a limitation and issues associated using examples</li></ul>	2–3
<ul style="list-style-type: none"><li>Identifies one limitation or benefit</li></ul>	1

**Question 30 (d) (i)***Outcomes assessed: H9, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>Correct ratio</li></ul>	1

**Question 30 (d) (ii)***Outcomes assessed: H9, H13, H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none"><li>Punnett square – correctly constructed</li><li>3 genotypes and phenotypes correctly predicted</li></ul>	3
<ul style="list-style-type: none"><li>Punnett square correct</li><li>Phenotypes correct – no genotypes ratio or vice versa</li></ul> OR <ul style="list-style-type: none"><li>Correct phenotypes and genotypes ratio with no Punnett square</li></ul>	2
<ul style="list-style-type: none"><li>Punnett square correctly constructed with no ratios given</li></ul>	1

**Question 30 (d) (iii)***Outcomes assessed: H6, H9, H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none"><li>Gives a reason for cross breeding experiments</li><li>Links cause and effect of phenotypes to parents</li><li>Relates position of linked genes to percentage of offspring</li></ul>	3–4
<ul style="list-style-type: none"><li>Outlines features of cross-breeding</li></ul> OR <ul style="list-style-type: none"><li>Identifies crossing over as the cause of recombinants</li></ul>	2
<ul style="list-style-type: none"><li>Makes a correct statement about cross-breeding or linked genes</li></ul>	1

**Question 31 (a) (i)***Outcomes assessed: H10, H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none"><li>Correct answer</li></ul>	1

**Question 31 (a) (ii)***Outcomes assessed: H10, H14***MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none"><li>Lists THREE correct reasons</li></ul>	3
<ul style="list-style-type: none"><li>Lists TWO correct reasons</li></ul>	2
<ul style="list-style-type: none"><li>Names ONE correct reason</li></ul>	1

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

<b>Criteria</b>	<b>Marks</b>
• TWO appropriate features correctly identified	2
• ONE appropriate feature correctly identified	1

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

<b>Criteria</b>	<b>Marks</b>
• Identifies appropriate issues and describes relevant points for and/or against	4
• Describes the fossil record and/or how it may be used to interpret the past	2–3
• Makes a correct statement about the fossil record or fossils	1

**Question 31 (c)***Outcomes assessed: H5***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
• Describes logical relationships between human evolution and increased population mobility, modern medicine and genetic engineering AND • Relates these to future trends	7
• Describes logical relationships between human evolution and increased population mobility, modern medicine and genetic engineering	5–6
• Outlines the relationship between increased population mobility, and/or modern medicine and/or genetic engineering to human evolution	2–4
• Identifies an appropriate issue relevant to the theme	1

**Question 31 (d) (i)***Outcomes assessed: H10, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>• Distinguishes between relative and absolute dating</li></ul> AND <ul style="list-style-type: none"><li>• Outlines an appropriate absolute dating technique</li></ul>	3
<ul style="list-style-type: none"><li>• Distinguishes between relative and absolute dating</li></ul> OR <ul style="list-style-type: none"><li>• Outlines an appropriate absolute dating technique</li></ul> OR <ul style="list-style-type: none"><li>• Outlines one of 'relative' or 'absolute' and outlines an appropriate technique</li></ul>	2
<ul style="list-style-type: none"><li>• Provides an outline of 'relative' dating or 'absolute' dating</li></ul> OR <ul style="list-style-type: none"><li>• Identifies one technique</li></ul>	1

**Question 31 (d) (ii)***Outcomes assessed: H10 H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>• Indicates a main feature of identified mechanism</li></ul>	2
<ul style="list-style-type: none"><li>• Identifies a mechanism</li></ul>	1

**Question 31 (d) (iii)***Outcomes assessed: H10, H14***MARKING GUIDELINES**

<b>Criteria</b>	<b>Marks</b>
<ul style="list-style-type: none"><li>• Shows similarities and/or differences in the evidence between TWO different named models of human evolution</li></ul>	3
<ul style="list-style-type: none"><li>• Outlines ONE named model of human evolution</li></ul>	2
<ul style="list-style-type: none"><li>• Identifies ONE feature of ONE named model of human evolution</li></ul> OR <ul style="list-style-type: none"><li>• Identifies TWO models</li></ul>	1

**Question 32 (a) (i)***Outcomes assessed: H6***MARKING GUIDELINES**

Criteria	Marks
• Correctly names pigment	1

**Question 32 (a) (ii)***Outcomes assessed: H6, H14***MARKING GUIDELINES**

Criteria	Marks
• Identifies THREE correct facts	3
• Identifies TWO correct facts	2
• Identifies ONE correct fact	1

**Question 32 (b) (i)***Outcomes assessed: H6, H14***MARKING GUIDELINES**

Criteria	Marks
• Identifies TWO microscopic structural differences between plant X & Y and relates them to oxygen production	3
• Identifies TWO microscopic structural differences based on the data provided	2
• Identifies two microscopic characteristics of plants associated with photosynthesis	1

**Question 32 (b) (ii)***Outcomes assessed: H6***MARKING GUIDELINES**

Criteria	Marks
• Identifies both sites correctly and outlines the location of the appropriate reaction	3
• Names both sites	2
OR	
• Names one site and makes an attempt at an explanation	1
• Names a site for photosynthesis in any part of the reaction	

**Question 32 (c)**
*Outcomes assessed: H5, H3*
**MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none"> <li>Describes the production of three named materials using new technologies and makes a judgement about their replacement with the use of photosynthesis</li> </ul>	6–7
<ul style="list-style-type: none"> <li>Describes at least TWO named materials using new technologies</li> <li>Identifies links with use of photosynthesis and replacement of current materials</li> <li>Discusses their use as replacement for current materials</li> <li>Makes a judgement</li> </ul>	4–5
<ul style="list-style-type: none"> <li>Identifies appropriate potential uses of photosynthesis</li> <li>Links use of photosynthesis and replacement of existing material(s)</li> </ul>	2–3
<ul style="list-style-type: none"> <li>Identifies an appropriate use of photosynthesis</li> </ul> OR <ul style="list-style-type: none"> <li>Identifies an appropriate material obtained from other non-renewable resources</li> </ul>	1

**Question 32 (d) (i)**
*Outcomes assessed: H6, H14*
**MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none"> <li>Relates the absorption of light to the production of chemical energy required by the plant to grow</li> <li>Demonstrates the relationship between maximum light penetration to maximising plant growth</li> </ul>	3
<ul style="list-style-type: none"> <li>Outlines function of appropriate filter</li> </ul>	2
<ul style="list-style-type: none"> <li>Identifies an appropriate filter</li> </ul>	1

**Question 32 (d) (ii)**
*Outcomes assessed: H6, H14*
**MARKING GUIDELINES**

Criteria	Marks
<ul style="list-style-type: none"> <li>Provides characteristics and features of PSI and PSII, identifying the site and products of each</li> <li>Provides cause and effect of the processes that occur</li> </ul>	4–5
<ul style="list-style-type: none"> <li>Outlines the role of PSI and PSII and outlines the processes that occur in each</li> </ul>	2–3
<ul style="list-style-type: none"> <li>Identifies the role of PSI or PSII</li> </ul>	1