2008 HSC Notes from the Marking Centre Biology

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2008 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 contains comments on candidate responses to the 2008 Higher School Certificate examination, indicating the quality of the responses and highlighting their relative strengths and weaknesses.

This document should be read along with the relevant syllabus, the 2008 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 2008, approximately 15 200 candidates attempted the Biology examination. The most popular options were Communication (64%), 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 course is assumed knowledge for the HSC course.

Teachers and candidates are reminded that mandatory skills content in Module 9.1 is examinable in both the core and option questions.

Candidates need to be reminded that the answer space provided and the marks allocated are guides to the maximum length of response required. Candidates should use examination time to analyse the question and plan responses carefully, working within that framework to produce a clear and concise response. The the use of dot points, diagrams and/or tables may help avoid internal contradictions. This is particularly important in holistic questions that 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:

- 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)).

In Section II, 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) of the 2008 option questions, the best responses presented ideas coherently and included the correct use of scientific principles and ideas. Many candidates wrote a lot of information that was not relevant to the question. Some responses showed evidence of rote learning of an anticipated answer based on a single source. These responses did not address the syllabus content and/or outcomes being assessed and hence did not score full marks. Candidates are required to attempt one question only in Section

II, but some candidates responded 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	D
2	A
3	B
4	B
5	C
6	D
7	A
8	C

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

Part B

Specific comments

Question 16

In the better responses, candidates demonstrated a good understanding of dominant and recessive alleles and could explain the presence of both coloured offspring in a heterozygous cross.

Question 17

(a) The weaker responses did not identify companion cells.

(b) In the weaker responses, candidates had difficulty describing features of the theory with respect to movement of materials in phloem tissue.

Question 18

(a) In the better responses, candidates based their assessment on the diagram and demonstrated a good knowledge of what was incorrect about the diagram. In the weaker responses a clear judgement statement was not made.

Question 19

The better responses demonstrated a thorough understanding of experimental design and showed the need for an experimental control and included references to the use of dependent and independent variables.

Question 20

The better responses correctly named a non-infectious disease and described its features. In the weaker responses, some candidates did not describe the occurrence of a named non-infectious disease, while others named an infectious disease.

Question 21

In the weaker responses, candidates did not correctly express natural selection concepts of evolution, and did not link the adaptation shown to natural selection. Many weaker responses wrongly described evolution in Lamarckian terms.

Question 22

In the better responses, candidates named the hormones involved and showed how their activity maintained water and salt levels in the blood. In the weaker responses, candidates had difficulty explaining the process of reabsorption.

Question 23

The better responses provided details of more than one change in the chemical composition of the blood in specific organs. In the weaker responses, candidates were unsure of specific chemical changes that occur in the small intestines.

Question 24

(a) In the better responses, candidates constructed a graph that had an appropriate scale, with axes set up correctly for the dependent and independent variable, and correctly plotted points. In the weaker responses, candidates had an inappropriate scale (ie not multiples of 2, 5 or 10) making it difficult to plot their points accurately. Some weaker responses produced poor quality graphs that were not done in pencil.

Question 25

(a) In the better responses, candidates demonstrated an understanding of the steps involved in polypeptide synthesis. In the weaker responses, candidates did not state the effect on the polypeptide.

(b) In the weaker responses, candidates did not relate a change in polypeptide activity to a specific change in cell activity, and answered in general terms.

Question 26

In the better responses, candidates demonstrated a good understanding of the concept of quarantine and provided support for the steps taken. In the weaker responses, candidates communicated an understanding of some form of quarantine but did not address the concept of the population remaining disease free.

Question 27

In the better responses, candidates demonstrated a depth of knowledge from their analysis of secondary sources. They named concepts and appropriate applications and linked these to societal implications, and supplemented the information supplied with their own knowledge gained from a study of the relevant sections of the syllabus. In the weaker responses, candidates had difficulty linking biological concepts with both specific methods and implications for society.

Question 28

(a) The weaker responses correctly named a meiotic process, but did not explain its effect on variation.

(b) In the better responses, candidates demonstrated a sound understanding of the link between a change in the environment and genetic variation in relation to survival. In the weaker responses, candidates simply identified the importance of a favourable characteristic in aiding survival.

Section II – Options

Question 29 Communication

(a) (i) Better responses were concise and named specific cellular receptors using correct biological terms, for example photoreceptors. Weaker responses identified sense organs such as eye and ear.

(ii) Better responses demonstrated a clear understanding of the steps involved in the stimulus–response process in humans and provided an appropriate example. Some weaker responses used homeostatic thermoregulation as an example rather than an external stimulus. Some weaker responses included lengthy outlines of the functioning of the eye or ear that were not required.

(b) In better responses, candidates described an appropriate first-hand investigation including the use of a control. These better responses also provided features and characteristics of gathering, processing and analysing information from secondary sources. Only the better responses identified the need to synthesise information from both sources.

(c) The question required candidates to link their knowledge of difficulties with sight and hearing to the appropriate technologies that have been developed to overcome the problems. Better responses demonstrated significant biological knowledge of both senses and technologies and linked the assistance of these technologies to improved communication.

(d) Better responses indicated a pathway through the key elements that also demonstrated a thorough understanding of the movement of sound waves through the cochlea. Many responses used a flowchart as an efficient method by which to represent the pathway of sound waves through the outer, middle and inner ear.

(e) Better responses linked the limitations of the cochlear implant.

Question 30 Biotechnology

(a) (i) In better responses, candidates named two organic compounds produced by biotransformation technologies. Weaker responses confused the products of fermentation or other earlier forms of biotechnology.

(b) (i) Better responses provided features and characteristics of the use of biotechnology by an early society. Some weaker responses did not make the link between aquaculture and the selective breeding process.

(c) In better responses, candidates described some aspects of an appropriate first-hand investigation and linked this to gathering, processing and analysing information from secondary sources. Only the better responses identified the need to synthesise information from both sources.

(d) Better responses demonstrated a thorough knowledge of modern biotechnological methods and related this with coherence and logical progression to the treatment of disease. Weaker responses described concepts from the core topic 'The Search for Better Health'.

(e) In better responses, candidates drew, labelled and showed the correct sequence for the formation of recombinant DNA. In weaker responses, the process was confused with protein synthesis and DNA replication.

(f) Better responses outlined one current use of recombinant DNA technology and provided features and characteristics of feasible areas of future research. Weaker responses either did not give a current recombinant DNA use or future directions for research.

Question 31 Genetics: the code broken?

(a) (i) In the better responses, candidates identified both cloning processes, highlighting the difference. Weaker responses described whole organism cloning as simply reproducing an entire organism.

(ii) Better responses correctly identified the need to examine both donor and clone at the genetic level and identified at least one step in the process of examining the genes. Weaker responses tested only physical features or described the cloning of Dolly.

(b) In the majority of responses, candidates described the skills required to perform first-hand investigations and to gather, process and analyse information from secondary sources. However, only the better responses identified the need to synthesise information from both sources. Some responses described mutations and/or crosses from a content perspective, rather than addressing the skills involved in planning investigations.

(c) In weaker responses, candidates did not connect their knowledge of genetics and mutation with either health or disease to the benefits of these scientific advances in improving health. Some weaker responses attributed the majority of genetic advances to the Human Genome Project (HGP) and this was often incorrect.

(d) In the better responses, candidates provided well-labelled diagrams of the cutting of the desired gene, a plasmid and the combination of excised parts. In weaker responses, the process was confused with protein synthesis and DNA replication.

(e) In better responses, candidates provided characteristics and features of both the limitations of the HGP data and areas of future research. Many responses used current research such as gene therapy for the treatment of cystic fibrosis.

Question 32 The human story

(a) Weaker responses incorrectly identified characteristics of hominins only, which could not be applied to other primates.

(b) Better responses correctly identified relative or absolute dating or named a specific method used to determine the age of fossils and then outlined the steps in this process.

(c) Better responses clearly described how to perform a first-hand investigation and how to gather, process and analyse information from secondary sources to determine a likely relationship of the fossil to the Homo genus. Some weaker responses described either how to conduct a first-hand investigation or how to gather, process and anlayse from secondary sources. Often the weaker responses listed all the features of hominins.

(d) In better responses, candidates clearly described and provided examples of both cultural development and polymorphism of humans. These responses linked the cultural development and polymorphism to the adaptive advantage incurred.
These better responses demonstrated a thorough knowledge and understanding of the adaptive advantage of either cultural development or polymorphism.

Weaker responses listed some examples of cultural development and/or polymorphism without identifying their adaptive advantage.

(e) Better diagrams identified a correct sequence of DNA–DNA hybridisation including the reheating of the DNA hybrid to determine the degree of complementarity.

(f) Many weaker responses described implications in the health area but did not then make any links to human evolution.

Question 33 Biochemistry

(a) (i) Better responses correctly identified X as adenine and Y as ribose.

(ii) Better responses identified that phosphate groups were the biologically important part of the ATP molecule because energy was released when the terminal phosphate was cleaved and that energy was used to drive biological reactions.

(b) In better responses, candidates described how to perform an appropriate first-hand investigation and how to gather, process and analyse secondary sources. Only the best responses identified the need to synthesise information from both sources.

(c) In better responses, candidates identified development in technology and strategies, for example electron microscopy and the use of radioisotopes, and clearly linked this to specific improvements in our understanding in photosynthetic processes.

(d) In better responses, the diagram identified the main chemical compounds involved in the carbon fixation, reduction and regeneration of the carbon dioxide acceptor parts of the Calvin Cycle and indicated where G3P left to be compiled into glucose.

(e) Better responses identified that photosynthesis was an energy-gathering process and proposed possible future research options to address the increasing need for energy supplies.

Biology

2008 HSC Examination Mapping Grid

Question	Marks	Content	Syllabus outcomes
Section I Part A			
1	1	9.2.2.2.3	H6
2	1	9.4.3.2.3	H6
3	1	9.3.5.1, 9.3.5.2.1	H9
4	1	9.2.1.2.5	H6
5	1	9.4.5.2.3	H6
6	1	9.2.1.2.7, 9.2.1.2.8	H8
7	1	9.3.3.2.5, 9.3.4.2.4	H9
8	1	9.1, H11.2(b)	H11
9	1	9.4.4.2.2	H6
10	1	9.4.5.1	H1, H6
11	1	9.3.1.2.2	H10
12	1	9.3.1.2.1, 9.3.1.3.2, 9.3.4.3.4, 9.4.3.3.4	H10
13	1	9.4.1.2.2	H6
14	1	9.2.3.2.5	H6
15	1	9.3.3.3.2	H9
Section I Part B			
16	3	9.3.2.2.3, 9.3.2.2.4	H9
17(a)	1	9.2.2.3.6, 13.1(e)	H6, H13
17(b)	3	9.2.2.2.6	H2, H6
18(a)	3	9.1, 9.2.2.3.2, 12.4(a), 14.1(a), 13.1 (e)	H6, H12, H13, H14
18(b)	1	9.1, 12.1(d), 11.3 (b)	H11, H12
19	4	9.1, 9.4.2.3.1, 9.4.2.3.2, 11.1(b), 11.2(b)(c)	H6, H11
20	5	9.4.6.3.2	H6
21	3	9.3.1.2.3	H10
22	5	9.2.3.2.6, 9.2.3.2.7	H6
23	4	9.2.2.2.1, 9.2.2.2.4	H6
24(a)	4	9.1, 13.1(f)(g)	H13
24(b)	2	9.1, 9.2.1.3.1, 14.1(a)(d)	H6, H14
25(a)	3	9.3.4.2.4	H9, H6
25(b)	2	9.3.4.3.2	H9, H6
26	3	9.4.7.2.1	H4, H8
27	8	9.4, 9.2.2.3.4, 13.1(a), 14.1(h), 9.1, 14.3(b)	H1, H3, H4, H6, H13, H14
28(a)	3	9.3.3.2.5, 9.3.3.3.1	H6, H9
28(b)	3	9.3.4.2.6	H10

Question	Marks	Content	Syllabus outcomes
Section II Question 29 — Communication			
(a) (i)	2	9.5.1.2.1	H6
(a) (ii)	3	9.5.1.2.2,	H6
(b)	6	9.1, 9.5.6.2.2, 12.3(a)(d), 14. 2(b), 11.1(a)(b)(e),	H6, H11, H12, H14
(c)	7	9.5.7.2.4, 9.5.3.3.3, 9.5.6.3.3, 9.5.3.2.5, 9.5.4.2.5	H3, H4, H6, H14
(d)	3	9.1, 9.5.6.2.4, 13.1(e)	H6, H13
(e)	4	9.5.6.3.3	H3, H5
Section II Question 30— Biotechnology			
(a)	2	9.6.3.2.4	H6
(b)	3	9.6.1	H1, H8
(c)	6	9.1, 9.6.2.2.1, 12.3(a)(d), 14.2(b), 11.1(a)(b)(e)	H6, H11, H12, H14,
(d)	7	9.6.6.2.2, 3, 9.6.6.3.1	H3, H4, H6
(e)	3	9.1, 9.6.5.2.1, 9.6.5.2.2, 13.1(e)	H6, H13
(f)	4	9.6.5, 14.3(c)	H3, H5, H6, H14
Section II Question 31 — Genetics: The Code Broken?			
(a) (i)	2	9.7.7.2.3	H7, H10
(a) (ii)	3	9.7.7.3.2	H9
(b)	6	9.1, 9.7.3, 9.7.6, 12.3(a)(d), 14.2(b), 11.1(a)(b)(e)	H9, H11, H12, H14
(c)	7	9.7.4, 9.7.6.3.1, 9.7.5	H1, H4, H9
(d)	3	9.1, 13.1(e), 9.7.4.2.3	H9, H13
(e)	4	9.7.4, 9.7.4.2.2	H3, H5, H9
Section II Question 32 — The Human Story			
(a)	2	9.8.1.2.5	H10
(b)	3	9.8.2.2.3, 4	H10
(c)	6	9.1, 9.8.1.3.1, 12.3(a)(d), 14.2(b), 11.1(a)(b)(e)	H10, H11, H12, H14
(d)	7	9.8.4, 9.8.5, 9.8.6	H1, H4, H7, H8, H10
(e)	3	9.1, 9.8.2.2.6, 3.1(e)	H10, H13
(f)	4	9.8, 9.8.6.3.2	H3, H5, H10
Section II Question 33 — Biochemistry			
(a) (i)	2	9.9.7.3.1	H6
(a) (ii)	3	9.9.7.2.2	H6
(b)	6	9.1, 9.9.4, 9.9.5, 12.3(a)(d), 14.2(b), 11.1(a)(b)(e),	H6, H11, H12, H14
(c)	7	9.9.2, 9.9.4, 9.9.5, 9.9.9.3	H1, H3, H6
(d)	3	9.1, 13.1(e), 9.9.6.2.3	H6, H13
(e)	4	9.9.1.3.2	H3, H5, H6

Section I, Part B

Question 16

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Correctly uses genotypes in answer to explain phenotypes of BOTH generations	3
• Correctly uses genotypes to explain phenotype of ONE generation	2
• Correctly links a genotype and phenotype	1

Sample answer:

The parents were heterozygous (Rr) and carried a recessive gene for white flowers. Thus, the offspring are mostly red (RR) but some have the double recessive making them white (rr).

Question 17 (a)

Outcomes assessed: H6, H13

MARKING GUIDELINES

Criteria	Marks
• Correctly labels TWO components	1

Sample answer:

Top label: Sieve (plate)
Bottom label: Companion cell

Question 17 (b)

Outcomes assessed: H2, H6

MARKING GUIDELINES

Criteria	Marks
• Provides features or characteristics of ONE theory linked to movement	3
• Correctly outlines ONE theory	2
• Correctly identifies ONE theory OR • Provides ONE feature of a theory	1

Sample answer:

Sugar is actively loaded at the source, which are often the leaves. The increase in sugar concentration draws water in by osmosis, which increases the pressure.

At the sink, sugars are used up and water flows out by osmosis, decreasing the pressure. Movement in the phloem occurs due to the pressure gradient.

Question 18 (a)

Outcomes assessed: H6, H12, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Makes a judgment about the accuracy of the diagram based on TWO valid observations	3
• Makes a judgment about the accuracy of the diagram based on ONE valid observation OR • Makes TWO valid observations	2
• ONE valid observation	1

Sample answer:

- Scale is wrong
- Relative size of red and white blood cells is wrong

Therefore, diagram is not accurate

Question 18 (b)

Outcomes assessed: H11, H12

MARKING GUIDELINES

Criteria	Marks
• Provides ONE valid reason related to safety	1

Sample answer:

The student could catch a disease from fresh blood.

Question 19

Outcomes assessed: H6, H11

MARKING GUIDELINES

Criteria	Marks
• Provides an experimental design for valid and reliable data collection which: - Includes a control - Identifies at least TWO variables to be kept constant - Includes repetition - Includes appropriate data collection method	4
• Any THREE of above	3
• Any TWO of above	2
• Any ONE of above	1

Question 19 (continued)

Sample answer:

A sample of water is collected from a dam. The sample is divided exactly into test and control samples. The test sample is treated with "the product" and the control sample is left untreated.

After one hour 5 ml from each sample is spread on separate agar plates and incubated overnight. The next day colonies are counted to determine if the product is effective.

The procedure is repeated five times.

Question 20

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Names a non-infectious disease • Provides appropriate characteristics/features of the non-infectious disease	5
• Names a non-infectious disease • Provides an outline of the features/characteristics of the non-infectious disease	3–4
• Names a non-infectious disease • Identifies ONE characteristic/feature	2
• Names a non-infectious disease	1

Sample answer:

Down Syndrome is a non-infectious disease that occurs in individuals with an extra No21 chromosome. Affected individuals have a round face, flattened nose, slanting eyes and delayed mental development. The rate of occurrence of Down Syndrome depends on the age of the mother. Many more Down Syndrome children are born to mothers over the age of 40. This condition cannot be treated but educational programs have been developed to help the learning of Down Syndrome children.

Question 21

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• States a reason for ear size and links it to natural selection in similar environments	3
• States a reason for ear size and links it to natural section or similar environments OR • Describes convergent evolution without stating a reason for ear size	2
• States a reason for similarity in ear size OR • Identifies convergence OR • Identifies natural selection	1

Sample answer:

- Each population of bilbies and jack rabbits has variation within their species
- However, both live in similar environments with similar selection pressures
- Over time, variations that help the species to survive are naturally selected for, eg larger ears for more heat loss in similar environments

Question 22

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Correctly names BOTH hormones involved in the regulation of water and salt in the blood • Identifies a site of hormone activity • Shows how each hormone acts in maintaining salt and/or water levels	5
• Correctly names both hormones involved in the regulation of water and salt in the blood • Identifies a site of hormone activity • Outlines the action of each hormone	4
• Names hormones involved in the regulation of water and salt in the blood • Identifies a site of hormone activity • Outlines action of ONE hormone OR • Names ONE hormone involved in the regulation of water and salt in the blood • Identifies a site of hormone activity • Shows how the hormone acts in maintaining salt and/or water levels OR • Names BOTH hormones • Shows how ONE hormone acts in maintaining salt and/or water levels	3
Provides any TWO of the following: • Names hormones involved in the regulation of water and salt in the blood • Identifies a site of hormone activity • Outlines action of one hormone	2
• Identifies a site of hormone activity OR • Names a hormones that affects salt and water levels	1

Sample answer:

If no fresh water is available, the kidneys will need to reabsorb more water. Therefore ADH and aldosterone will be produced. ADH will cause more water to be reabsorbed. Aldosterone will cause salt re-absorption, which will lead to water re-absorption. Therefore both hormones will help water and salt levels to be maintained.

Question 23

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Provides details of at least FOUR similarities/differences OR • Provides details of the same similarity/difference as it affects all three organs	4
• Provides details of THREE similarities/differences	3
• Provides details of TWO similarities/differences	2
• Identifies ONE similarity/difference	1

Sample answer:

When blood flows through each of the organs the amount of nitrogenous wastes increases. When blood flows through the brain and small intestine the amount of carbon dioxide increases but the amount of oxygen decreases. This is different to the lungs where oxygen levels increase while carbon dioxide levels decrease. Blood travelling through the small intestine absorbs dissolved nutrients. These levels decrease when blood passes through the other organs.

Question 24 (a)

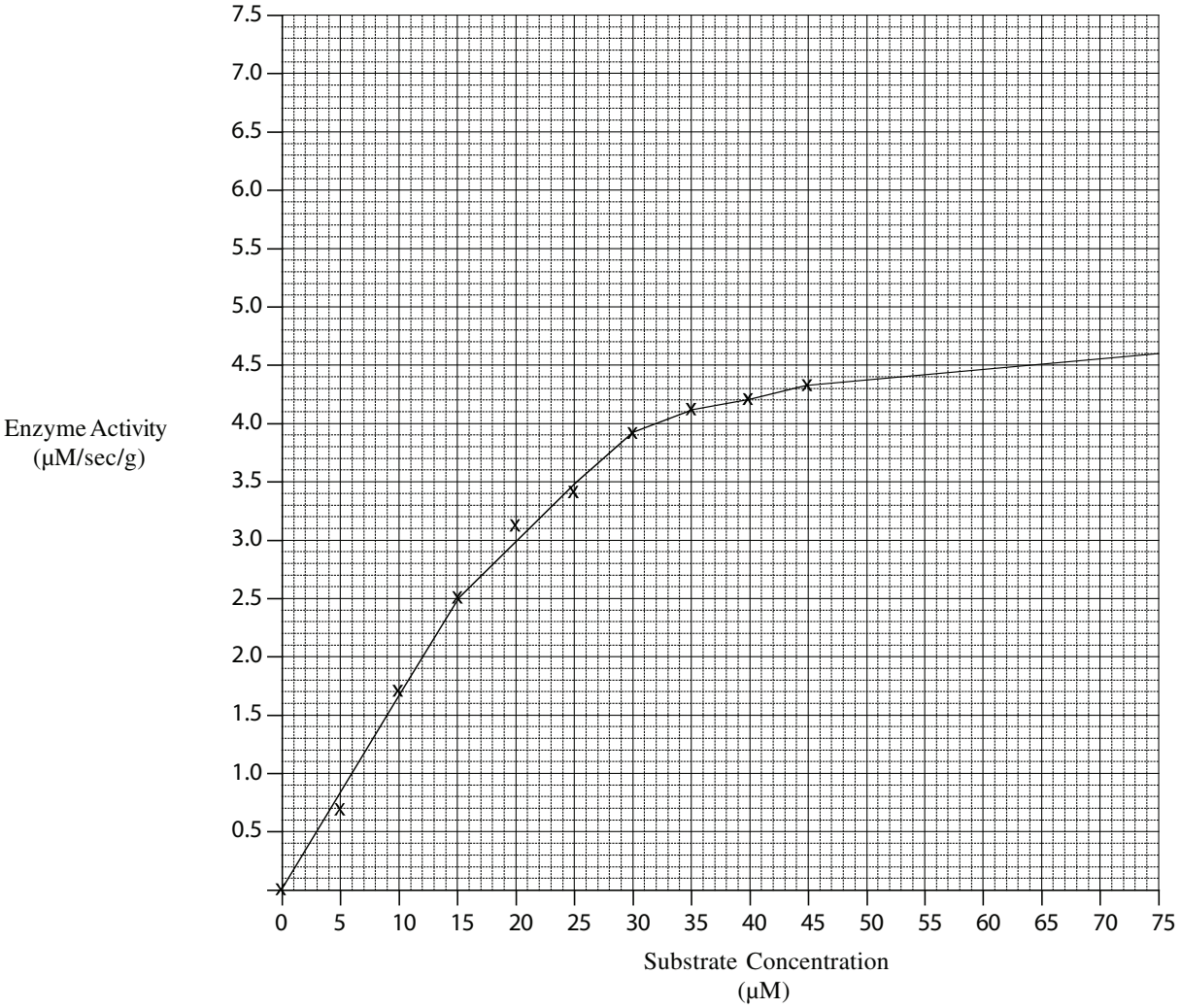
Outcomes assessed: H13

MARKING GUIDELINES

Criteria	Marks
• Draws an appropriate graph which includes axes correctly set up • Labels axes correctly (including units) • Plots points correctly • Neatly connects the plotted points OR provides a line of best fit	4
• Any three of the above	3
• Any two of above	2
• Any one of above	1

Question 24 (a) (continued)

Sample answer:



Question 24 (b)

Outcomes assessed: H6, H14

MARKING GUIDELINES

Criteria	Marks
• Extrapolates graph correctly and provides a correct prediction	2
• Extrapolates incorrectly, and provides a correct prediction OR • Extrapolates correctly and provides an incorrect prediction	1

Sample answer:

- See graph
- 4.5µM/sec/g

Question 25 (a)

Outcomes assessed: H6, H9

MARKING GUIDELINES

Criteria	Marks
• States that a change in DNA base sequence has occurred • States that this leads to a change in the way amino acids are coded • States that this, in turn, leads to a change in polypeptide	3
• States only TWO links from DNA base sequence to amino acids to polypeptide	2
• States ONE of the above	1

Sample answer:

A mutation in DNA changes the bases, which means that the amino acids making up the polypeptide are different. This means that a different polypeptide is formed.

Question 25 (b)

Outcomes assessed: H6, H9

MARKING GUIDELINES

Criteria	Marks
• Relates polypeptide to a cell activity • Shows how a change in polypeptide would affect this activity	2
• ONE of the above	1

Sample answer:

A change in polypeptide leads to change in protein structure. If the protein is an enzyme, the cellular reaction it is involved in won't happen.

Question 26

Outcomes assessed: H4, H8

MARKING GUIDELINES

Criteria	Marks
• Identifies steps to ensure the population remains disease free and provides support for the steps	3
• Identifies steps with no support • OR • Identifies ONE step with support	2
• Identifies ONE step	1

Sample answer:

Take a population of disease-free animals and relocate them to an island off the coast of Tasmania. This would ensure that they cannot come into contact with diseased animals and become infected.

Question 27

Outcomes assessed: H1, H3, H4, H6, H13, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of relevant biological concepts • Explains these concepts • Demonstrates clear links between the applications of the concepts and the implications for society • Demonstrates coherent and logical progression and correct use of biological terms	7–8
• Demonstrates a sound knowledge of relevant biological concepts • Explains these concepts • Provides some links to the implications for society	5–6
• Provides TWO relevant biological concepts explained, with a limited link to the implications for society OR • Provides more than TWO relevant biological concepts explained	3–4
• Provides some implications, but no biological explanations OR • Describes ONE relevant biological concept OR • Names some relevant biological concepts	1–2

Answers may include:

As our understanding of biological concepts has improved, so too has our ability to save lives using donated blood. This has had a huge impact on society, as both blood transfusions and blood donations are now regarded as fairly safe, routine procedures. However, this current state of affairs only came about due to the many advances in our knowledge. These, and their implications for blood banking and society, are described in the following table:

Question 27 (continued)

Sample answer:

Understanding of Biological Concept	***Application of Concept/Blood banking method***	***Implications for society***
Blood has different types (ABO)	Blood, if correctly matched, can be transferred from one human to another	Save lives after accidents, during surgery, or due to illnesses such as haemophilia
Patients do not necessarily need whole blood	Separation of blood into its components	One donation can be used multiple times
Plasma donation	Plasma and platelets can be collected and the other blood components returned to the donor	Donor can donate more often, don't feel tired/lethargic afterwards
Collected blood can be stored	Can freeze or refrigerate for limited periods of time	Can transfer blood donations from one location to another, can be kept until required
Low temperatures slow down microbial growth	Storage of blood needs the temperature to be decreased	Less infections from donated blood/decreased spread of disease, safer for patients
Cells have particular requirements, thus blood donations needs additives so that these requirements can be met e.g. anticoagulants required to stop the blood clotting, citrate to make sure the level of salts and water remain constant so that the cells do not burst, mannitol to keep the pH correct, so that the enzymes can function within the cells and other reactions can continue to occur, glucose so that the cells can produce energy	Particular chemicals are added when storing blood	Donated blood can be stored and remain functional, so that it can be used at a later date
Cells cannot be frozen, or the water crystals pop the cells	Only plasma can be frozen	Plasma can be stored for longer periods of time. Unfortunately, blood components containing cells cannot, therefore regular donations are still required

Question 27 (continued)

Sample answer:

Understanding of Biological Concept	***Application of Concept/Blood banking method***	***Implications for society***
Blood can carry diseases e.g. HIV, bacteria, prions	Donors who may have been exposed to prions are asked not to donate Tests are conducted to see if the patient has high levels of antibodies, to see if they are currently fighting an infection. Blood is filtered to remove bacteria Platelets are not irradiated in case the radiation causes mutations in the bacterial DNA	Spread of disease is reduced. Safer transfusions for patients
Donors can catch diseases while donating	Sterile, disposable needles are used, not the same one used for multiple patients. The area around the injection site is swabbed with alcohol to kill micro-organisms on the skin	Donors have less risk when donating, so they are more likely to donate
White blood cells contain antigens which can set off the immune response	Only low levels of white blood cells are allowed in blood transfusions	Less risk of rejection of the blood, so safer for the patient to have a transfusion. More patients can receive transfusions, even ones with weakened immune systems
Artificial blood should be possible to create	Use both artificial and donated blood, or perhaps even only artificial blood	No or fewer donations required, less risk of spread of disease, patients don't need to wait until matching blood types can be found

Question 28 (a)

Outcomes assessed: H6, H9

MARKING GUIDELINES

Criteria	Marks
• Correctly relates cause and effect of ONE meiotic process leading to genetic variation	3
• Describes ONE meiotic process OR • Identifies ONE meiotic process and the effect it has on genetic variation	2
• Identifies ONE meiotic process	1

Sample answer:

Crossing over means that alleles on one chromatid can be exchanged with another chromatid. When the gametes are formed the chromosomes contain different combinations of alleles.

Question 28 (b)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
Demonstrates understanding by including these THREE ideas: - Change in environment occurs - Organisms with variations best suited to the environment survive - These organisms reproduce	3
• Includes TWO of the above ideas	2
• Includes ONE of the above ideas	1

Sample answer:

If there is a change in the environment, some organisms may be better suited to the new environment and can therefore survive and reproduce.

Section II

Question 29 (a) (i)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Identifies TWO receptors	2
• Identifies ONE receptor	1

Sample answer:

Photo receptor (in the eye)
Hair cell (in the ear)

Question 29 (a) (ii)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Provides complete set of steps from the receptor to the response	3
• Provides incomplete set of steps	2
• Identifies effector OR response OR transmission pathway	1

Answers could include:

Photoreceptor detects light → sensory neuron transmits signal to brain → brain determines response eg pupil constriction → motor neuron transmits signal to iris muscle → iris muscle responds to restrict light entering the eye

Question 29 (b)

Outcomes assessed: H6, H11, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Describes how to perform an appropriate first-hand investigation • Describes how to gather, process and analyse information from secondary sources • Identifies the need to synthesise information from both sources	5–6
• Describes only first-hand or second hand investigations OR • Outlines how to perform an appropriate first-hand investigation and second hand investigations	3–4
• Outlines an appropriate first or second hand investigation that could be carried out	1–2

Answers could include:

Research on the internet, books and journals to find out what is known already about insect tympanic membranes and the types of structures used by insects to aid with the detection of vibrations.

– Eg If it is found that other insects have flat disks on other limbs that function as tympanic membranes, this makes it more likely that these flat disks act as tympanic membranes.

Then conduct a first-hand investigation on a number of these insects to help determine if they are using the flat disk as a tympanic membrane.

– If the flat disks are removed from a group of insects and they then no longer respond to mating calls or other vibrations, it is likely that they are using the flat disks as tympanic membranes.

Make sure the investigation has a control group as well as a test group.

Compare the first-hand and second-hand information, and if both sets of data agree, it is highly likely that these disks are being used as tympanic membranes.

Question 29 (c)

Outcomes assessed: H3, H4, H6, H14

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of how sight and hearing are used in communication • Shows how an understanding of sight has improved communication for people with sight difficulties • Shows how an understanding of hearing has improved communication for people with hearing difficulties • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates sound knowledge of how sight and hearing are used in communication • Outlines ways to improve communication for people with sight and/or hearing difficulties • Communicates using clear written expression and uses some biological terms	4–5
• Demonstrates basic knowledge of how sight and/or hearing are used in communication • Identifies ways to improve communication for people with sight and/or hearing difficulties • Communicates in a basic manner and uses some general biological terms	2–3
• Identifies difficulties in sight/hearing OR • Identifies a way to improve communication	1

Answers could include:

Understanding how our receptors for sight or hearing are stimulated and how these signals are transmitted to the brain and then interpreted has lead us to identify where a fault has occurred when someone cannot see, hear or speak properly. For example, someone with cataract has a cloudy lens, which means that light cannot stimulate the photoreceptors. The lens is removed and the person can see again. The bionic ear replaces the hearing receptors from a deaf person allowing them to hear.

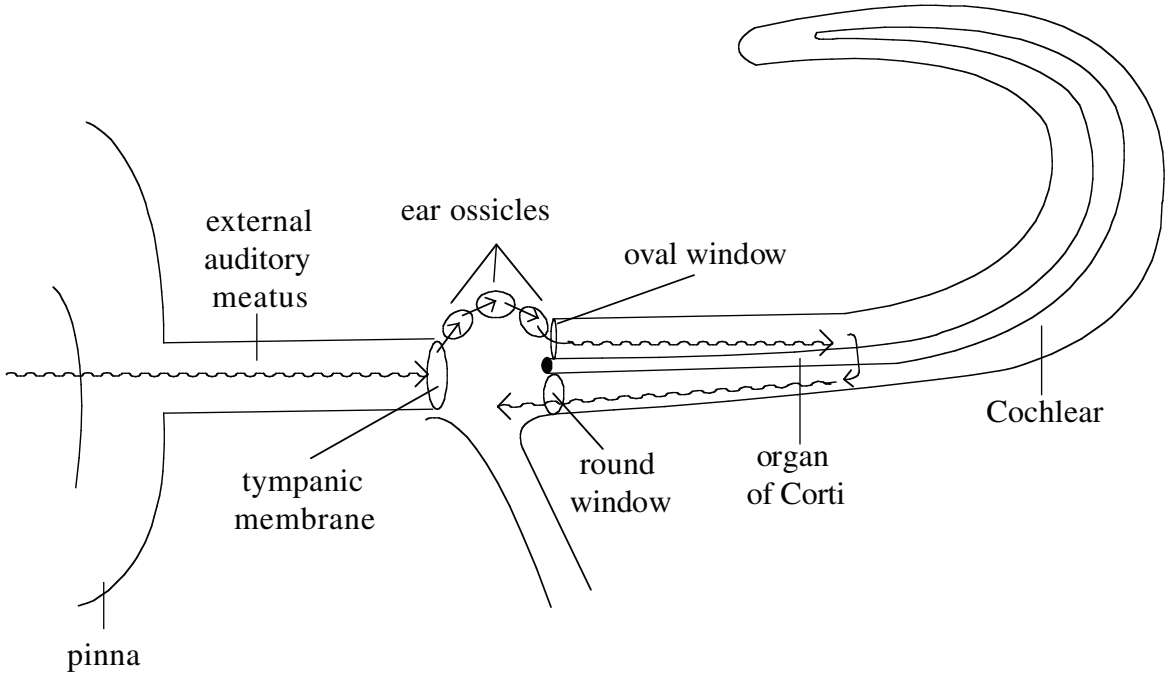
Question 29 (d)

Outcomes assessed: H6, H13

MARKING GUIDELINES

Criteria	Marks
• Draws a diagram showing the path of soundwaves through the ear (can be a flow chart) • Correctly labels and uses appropriate terminology of key elements • Provides correct sequence for pathway	3
• Draws a diagram of soundwaves in the ear • Provides some correct labels and sequence	2
• Provides some relevant information in a diagram	1

Answers could include:



Pinna→external auditory meatus→tympanic membrane→ear ossicles→oval window→organ of Corti→round window

Question 29 (e)

Outcomes assessed: H3, H5

MARKING GUIDELINES

Criteria	Marks
• Outlines ONE current limitation of cochlear implants • Provides features and characteristics of reasonable area(s) of future research	3–4
• Names ONE current limitation of cochlear implants • Outlines ONE possible area of research	1–2

Question 29 (e) (continued)

Sample answer:

One major limitation for cochlear implants is that the recipient has to learn to interpret the "sounds" that the implants produces and this can sometimes be difficult and even considered more confusing than not hearing at all. This is particularly a problem when cochlear implants are inserted into adult patients. Further research should be conducted into finding out when is the best age to insert cochlear implants so that the brain can most easily learn to interpret the signals from the implant. If this were very early then techniques for surgery that have less risks would be important. Further research into the ways to help people become accustomed to these new signals would also be useful.

Question 30 (a)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Correctly names TWO appropriate organic compounds	2
• Correctly names ONE appropriate organic compound	1

Sample answer:

Cortisone
Testosterone

Question 30 (b)

Outcomes assessed: H1, H8

MARKING GUIDELINES

Criteria	Marks
• Describes the use of biotechnology by an early society	3
• Outlines the use of biotechnology by an early society	2
• Identifies the use of biotechnology by an early society	1

Sample answer:

Aborigines at Lake Condah in Western Victoria constructed eel farms to breed eels in larger quantities as a food source.

Question 30 (c)

Outcomes assessed: H6, H11, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Describes how to perform an appropriate first-hand investigation • Describes how to gather, process and analyse information from secondary sources • Identifies the need to synthesise information from both sources	5–6
• Describes only first-hand or second-hand investigations OR • Outlines how to perform an appropriate first-hand investigation and second-hand investigations	3–4
• Outlines an appropriate first or second hand investigation that could be carried out	1–2

Answers could include:

Carry out a second-hand investigation by completing an internet or journal search to find out if studies have been carried out to produce sourdough bread consistently.

Identify variables such as amount of "starter" temperature of "starter", amount of ingredients and so on. Carry out controlled, repeated experiments to determine the best method for sour dough bread making.

Compare the information from first-hand and second-hand sources to develop the best method for making a consistent product.

Question 30 (d)

Outcomes assessed: H3, H4, H6

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of modern biotechnological methods • Shows how an understanding of how these have contributed to the treatment of disease • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates sound knowledge of modern biotechnological techniques • Outlines how these can be used in the treatment of disease • Communicates using clear written expression and uses some biological terms	4–5
• Demonstrates basic knowledge of modern biotechnological techniques • Identifies ways to use these to treat disease • Communicates in a basic manner and uses some biological terms	2–3
• Identifies some modern biotechnological method used to treat disease	1

Question 30 (d) (continued)

Answers could include:

Modern biotechnology has centered on a better understanding of DNA and the ability to manipulate it. In particular DNA can be cut and spliced, inserted into hosts to transform them. DNA can be amplified using PCR. In medicine, if someone has a defective gene leading to an illness, it is possible to amplify a correct copy of the gene using PCR and deliver it by a nasal spray where it would be take up by the persons cells and hence they would have the non-defective gene and be cured. In other cases, a protein such as insulin could be produced by taking the gene and transforming a yeast or bacterium that would then produce the protein in large amounts. The insulin can then be purified to give a consistent and large amount of insulin. This is a better way to treat diabetes.

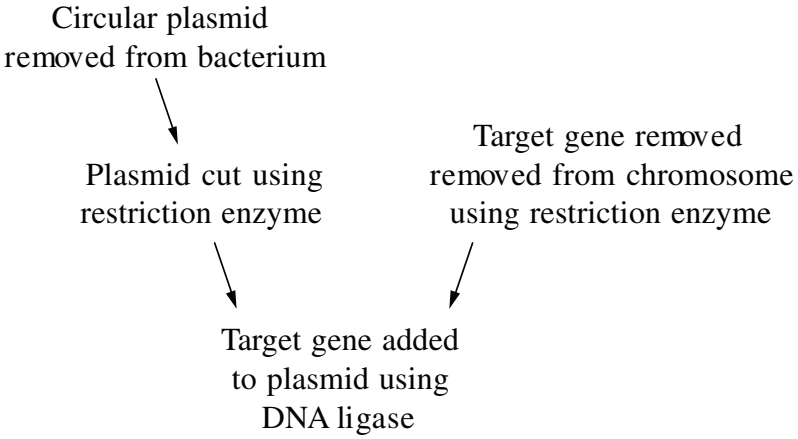
Question 30 (e)

Outcomes assessed: H6, H13

MARKING GUIDELINES

Criteria	Marks
• Draws a diagram showing formation of recombinant DNA (can be flow chart) • Correctly labels and uses appropriate terminology • Provides correct sequence	3
• Draws a diagram of recombinant DNA formation • Provides some correct labels and sequence	2
• Provides some relevant information in diagram	1

Sample answer:



Question 30 (f)

Outcomes assessed: H3, H5, H6, H14

MARKING GUIDELINES

Criteria	Marks
• Outlines ONE current use of recombinant DNA technology • Provides features and characteristics of reasonable area(s) of future research	3–4
• Names a current use of recombinant DNA technology • Outlines a possible area of research	1–2

Sample answer:

Recombinant DNA technology involves the transfer of genes from one organism to another. Research could be carried out to identify organisms that remove heavy metals from polluted water. The genes that assist in this process could be identified, and then inserted into harmless bacteria. Industrial processes could be developed to use these genetically engineered bacteria to remove heavy metals from polluted water.

Question 31 (a) (i)

Outcomes assessed: H7, H10

MARKING GUIDELINES

Criteria	Marks
• Identifies both processes highlighting a difference	2
• States meaning of gene cloning or whole organism cloning	1

Sample answer:

Gene cloning involves the cloning of a single gene on a single chromosome. Whole organism cloning involves the transfer of an entire complement of chromosomes.

Question 31 (a) (ii)

Outcomes assessed: H9

MARKING GUIDELINES

Criteria	Marks
• Identifies the need to examine both the donor and the clone at a genetic level • Identifies TWO steps in the process of examining the genes	3
• Identifies the need to examine both the donor and the clone at a genetic level and identifies ONE step in the process OR • Identifies TWO steps in the process	2
• Identifies the need to examine BOTH the donor and the clone at a genetic level OR • Identifies ONE step in the process	1

Sample answer:

Obtain a sample of tissue from both the clone and the donor, extract DNA from both samples, perform DNA sequencing of target genes and compare results.

Question 31 (b)

Outcomes assessed: H9, H11, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Describes how to perform an appropriate first-hand investigations • Describes how to gather, process and analyse information from secondary sources • Identifies the need to synthesise information from both sources	5–6
• Describes only first-hand or second hand investigations OR • Outlines how to perform an appropriate first-hand investigation and second -hand investigations	3–4
• Outlines an appropriate first or second-hand investigation that could be carried out	1–2

Answers could include:

Isolate DNA from the offspring and parents. Sequence the DNA to determine if there are mutations in the offspring DNA compared to the parent DNA.

Investigate secondary sources such as the internet and journal articles to determine whether this phenomenon has been discovered previously.

Analyse the results to determine whether this was caused by a mutation and whether this event is the same as what was witnessed in the primary investigation.

Question 31 (c)

Outcomes assessed: H1, H4, H9

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of genetics and genetic mutations • Shows an understanding of how these impact human health and disease • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates sound knowledge of genetics and genetic mutations • Outlines how these impact human health and disease • Communicates using clear written expression and uses some biological terms	4–5
• Demonstrates basic knowledge of genetics and genetic mutation • Identifies ways that these affect human health and disease • Communicates in a basic manner and uses some biological terms	2–3
• Identifies some link between genetic mutation and human health and disease	1

Question 31 (c) (continued)

Answers could include:

We now know that specific genes are found on particular chromosomes and for any gene there can be variation. Damage to a particular chromosome through radiation or cell division can alter particular genes. Mapping genes and their variants to specific regions on chromosomes (human genome project) has allowed us to understand whether a particular disease is likely if a faulty chromosome is detected. Recombinant DNA technology is used to determine where a particular gene is located and whether the gene has a mutation. This knowledge can be used to decrease or prevent the disease. For example, the potential to develop breast cancer can be detected and the breast be removed before the cancer emerges, or hormones used to prevent the cancer from developing.

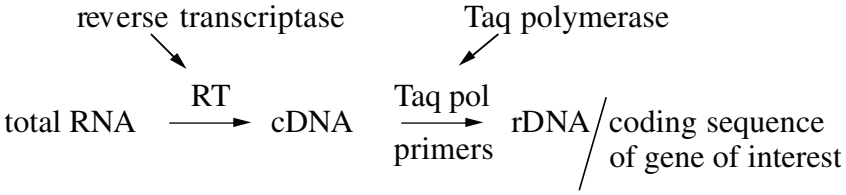
Question 31 (d)

Outcomes assessed: H13

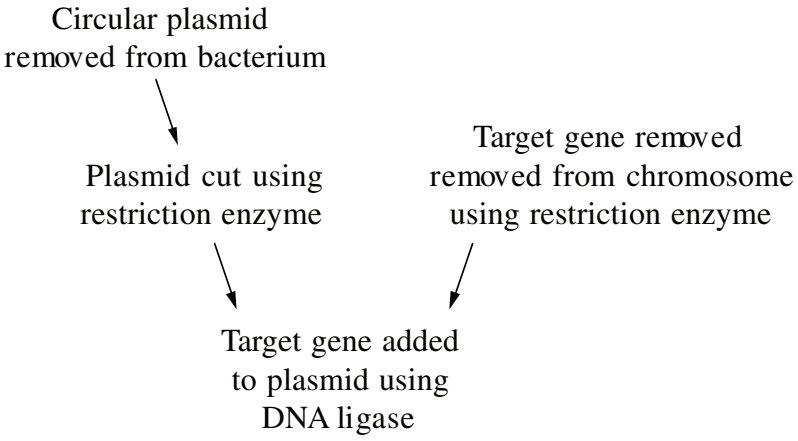
MARKING GUIDELINES

Criteria	Marks
• Draws a diagram showing formation of recombinant DNA • Correctly labels and uses appropriate terminology • Provides a correct sequence	3
• Draws a diagram of recombinant DNA formation • Provides some correct labels and sequence	2
• Provides some relevant information in diagram	1

Answers could include:



OR



Question 31 (e)

Outcomes assessed: H3, H5, H9

MARKING GUIDELINES

Criteria	Marks
• Outlines ONE limitation of HGP data • Provides features and characteristics of reasonable area(s) of future research	3–4
• Names ONE limitation of HGP data • Outlines a possible area of research	1–2

Sample answer:

The Human Genome Project has mapped out the location/position of genes on chromosomes. The identification of genes on a chromosome enables the deciphering of gene clusters that could be involved in disease processes. This information can be used to screen individuals for a particular disease and/or "tailor" therapies to ameliorate a particular disease. The HGP has also revealed non-coding RNA sequences that are important in regulating protein production. These non-coding sequences can also be used therapeutically to silence/decrease the production of a particular protein.

Question 32 (a)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Identifies TWO relevant characteristics of humans	2
• Identifies ONE relevant characteristic of humans	1

Sample answer:

Has opposable thumb and big brain relative to body size.

Question 32 (b)

Outcomes assessed: H10

MARKING GUIDELINES

Criteria	Marks
• Identifies a suitable method • Outlines at least TWO steps in the method	3
• Identifies a suitable method • Outlines ONE step in the method	2
• Identifies a suitable method	1

Sample answer:

One method is absolute dating. This where a sample of the fossil or rock layer in which it is found is taken and analysed. The decay of particular radioisotopes found in fossils and rocks can be measured and therefore the time taken for this decay to occur can be calculated. This provides a very good indication of the age of the fossil.

Question 32 (c)

Outcomes assessed: H10, H11, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Describes how to perform an appropriate first-hand investigation • Describes how to gather, process and analyse information from secondary sources • Identifies the need to synthesise information from both sources	5–6
• Describes only first-hand or second-hand investigation OR • Outlines how to perform an appropriate first-hand investigation and second-hand investigations	3–4
• Outlines an appropriate first- or second-hand investigation that could be carried out	1–2

Answers could include:

- Make detailed observations of the features of the skeleton, eg body structure and cranial capacity.
- Compare these observations to skeletons of other Homo species.
- Carry out internet and journal searches to find out if similar skeletons have been found elsewhere.
- If the skeleton has sufficient DNA, obtain and compare with *Homo Sapien DNA*.
- Use all of this information to decide if this is a new species of Homo.

Question 32 (d)

Outcomes assessed: H1, H4, H7, H8, H10

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of cultural development and of polymorphism • Shows an understanding of how these impact on human adaptation to the environment • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates sound knowledge of cultural development and of polymorphism • Outlines how these impact on human adaptation to the environment • Communicates using clear written expression and uses some biological terms	4–5
• Demonstrates basic knowledge of cultural development and / or polymorphism • Identifies ways that these affect human adaptation to the environment • Communicates in a basic manner and uses some biological terms	2–3
• Identifies some link between human adaptation to the environment and cultural development and/or polymorphism	1

Question 32 (d) (continued)

Answers could include:

One model of human evolution suggests they evolved in Africa. As their culture developed, they started cooperating as hunters in groups and developed language to coordinate their actions. This allowed humans to expand their distribution from Africa to other parts of the world.

Humans in different areas of the world show polymorphic variations such as skin colour. Humans living in equatorial regions had more individuals with darker skin compared to those in higher latitudes. This is thought to be an adaptation to the amount of UV radiation received. Today, increased migration has resulted in dark and light skinned humans being found in many regions.

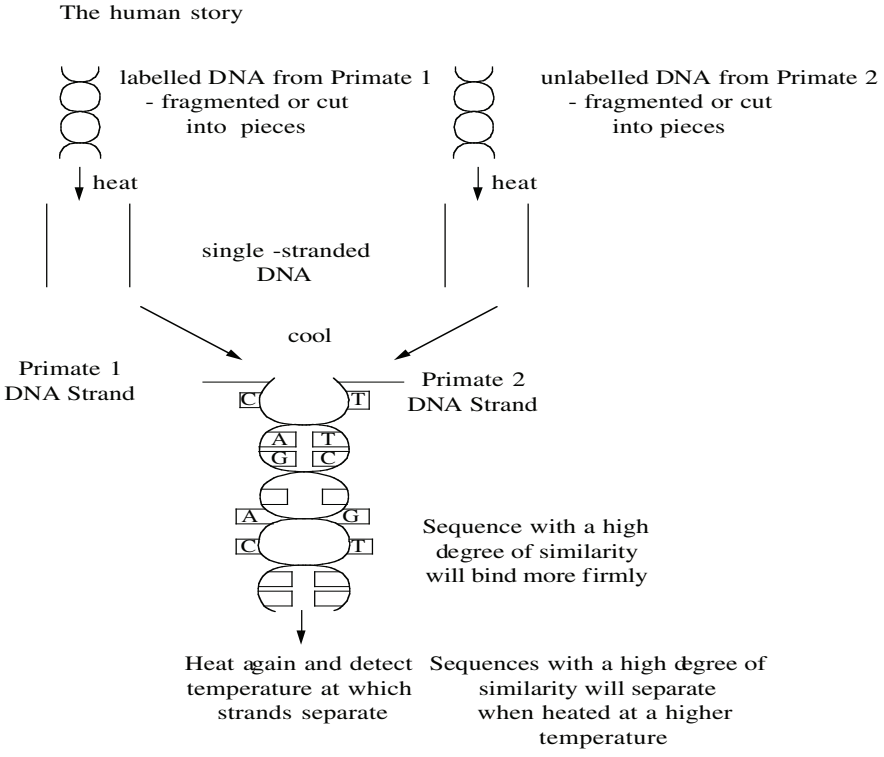
Question 32 (e)

Outcomes assessed: H10, H13

MARKING GUIDELINES

Criteria	Marks
• Draws a diagram showing the process of DNA-DNA hybridisation • Correctly labels and uses appropriate terminology • Provides a correct sequence	3
• Draws a diagram of DNA-DNA hybridisation • Provides some correct labels and sequence	2
• Provides some relevant information in diagram	1

Answers could include:



Question 32 (f)

Outcomes assessed: H3, H5, H10

MARKING GUIDELINES

Criteria	Marks
• Outlines implications of HGP • Show how these inform understanding of human evolution	3–4
• Identifies implications of HGP AND/OR • Outlines a possible area of development of understanding of human evolution	1–2

Sample answer:

The human genome project has led to an increased understanding of the genes found in humans and the roles they may play. The study of the genomes of humans across time may tell us something about the evolutionary change in our genes and therefore what genes may be important for successful evolution. An understanding of our genetic make-up may lead us to make decisions about our future evolution, such as choosing to mate with someone showing no genetic disposition to inheritable diseases.

Question 33 (a) (i)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Provides TWO correct names	2
• Provides ONE correct name	1

Sample answer:

X – adenine
Y – ribose

Question 33 (a) (ii)

Outcomes assessed: H6

MARKING GUIDELINES

Criteria	Marks
• Identifies cleavage of the bond • Identifies that this releases energy • States that energy can be used by the organism	3
• States that energy can be used by the organism AND EITHER • Identifies cleavage of the bond OR • Identifies that this releases energy	2
• Identifies that the energy can be used by the organism OR • Identifies that this releases energy	1

Answers could include:

Breaking the bond between phosphate groups releases energy that can be used to drive other biochemical reactions, (or produce heat).

eg. ATP → ADP + Pi + some energy
ATP → AMP + PPi + more energy

Question 33 (b)

Outcomes assessed: H6, H11, H12, H14

MARKING GUIDELINES

Criteria	Marks
• Describes how to perform an appropriate first-hand investigation • Describes how to gather, process and analyse information from secondary sources • Identifies the need to synthesise information from both sources	5–6
• Describes only first-hand or second hand investigations OR • Outlines how to perform an appropriate first-hand investigation and second-hand investigations	3–4
• Outlines an appropriate first or second-hand investigation that could be carried out	1–2

Question 33 (b) (continued)

Sample answer:

To investigate if this were photosynthesis I would look at secondary sources to see if the same or similar species had been discovered before and evaluate if they used photosynthesis to produce sulphur.

For a first hand study I would take part of the plant and put it in an atmosphere containing an isotope of sulphur $H_2 S^{33}$ I would illuminate it with red light and compare S^{33} production with the same specimen incubated with green light. Photo pigments do not absorb green light.

Use the information from both sources to determine both sources to determine if this is a photosynthetic reaction.

Question 33 (c)

Outcomes assessed: H1, H3, H6

MARKING GUIDELINES

Criteria	Marks
• Demonstrates a thorough knowledge of development of technologies and strategies used to investigate plant biochemistry • Shows an understanding of how these developments have contributed to the understanding of photosynthesis • Demonstrates coherence and logical progression and includes correct use of scientific principles and ideas	6–7
• Demonstrates sound knowledge of development of technologies and strategies used to investigate plant biochemistry • Outlines how these developments have contributed to the understanding of photosynthesis • Communicates using clear written expression and uses some biological terms	4–5
• Demonstrates basic knowledge of technologies AND/OR strategies used in plant biochemistry • Identifies ways these have contributed to understanding of photosynthesis • Communicates in a basic manner and uses some biological terms	2–3
• Identifies some technology OR strategy used to investigate an aspect of biochemistry	1

Answers could include:

Developments in our understanding of photosynthesis led to the concept of organelles within a cell carrying out specific roles. These developments such as the isolation and study of chloroplasts using centrifugation allowed us to isolate and study other organelles such as mitochondria, cell nuclei, and Golgi apparatus. In a similar way biochemical processes were separated from each other in studies of photosynthesis where a process was studied by using a radioactive substrate and looking at the products at different times. The products were separated from each other using chromatography. Chromatography is now used for separating all sorts of molecules from each other in cells such as proteins.

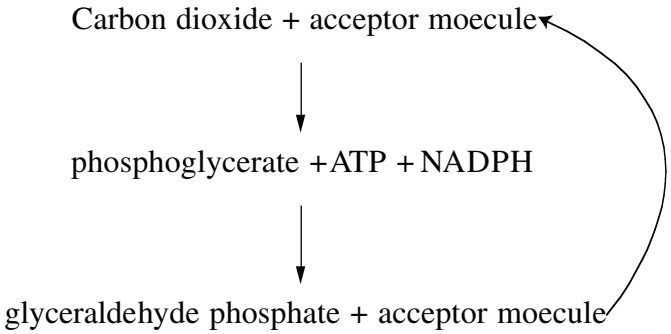
Question 33 (d)

Outcomes assessed: H6, H13

MARKING GUIDELINES

Criteria	Marks
• Draws diagram showing the Calvin Cycle (can be flow chart) • Correctly labels and uses appropriate terminology • Provides a correct sequence	3
• Draws a diagram of Calvin cycle • Provides some correct labels and sequence	2
• Provides some relevant information in diagram	1

Sample answer:



Question 33 (e)

Outcomes assessed: H3, H5, H6

MARKING GUIDELINES

Criteria	Marks
• Outlines photosynthesis as an energy gathering process • Provides features and characteristics of reasonable area(s) of future research	3–4
• Identifies photosynthesis as an energy gathering process • Outlines possible area of research	1–2

Sample answer:

Current evidence indicates that CO_2 in the atmosphere is increasing and O_2 is decreasing due to using fossil fuels as energy sources. Photosynthesis is a natural way of producing new energy sources (glucose, ethanol), which are renewable. It is a natural process of converting CO_2 and H_2O to a carbohydrate and giving O_2 as a by-product. Understanding the details and efficiency of this process will enable us to develop new species of bacteria or plants that are able to be very efficient in photosynthesis e.g. breed plants with leaves that have more chloroplasts. Eventually we might be able to develop an artificial system for this process: something similar to generating electricity from solar energy.