

2008 Trial HSC Examination Mapping Grid

Biology

Exam Section	Question	Marks	Syllabus/Course outcomes	Content	Targeted performance band	Answer
Part A – Multiple Choice	1	1	H6	9.2.1.1.4	2-3	A
	2	1	H6	9.2.2.1.3	4-5	C
	3	1	H6	9.2.2.1.4	2-3	B
	4	1	H6	9.2.3.2.5	3-4	C
	5	1	H13	9.2.3.2.7	3-4	A
	6	1	H9	9.3.4.1.2	2-3	D
	7	1	H9, H13	9.3.4.1.1	3-4	C
	8	1	H6, H13	9.4.4.1.4	2-3	B
	9	1	H6	9.4.5.1.1	2-3	B
	10	1	H6	9.4.6.1.2	3-4	B
	11	1	H6	9.4.5.1.3	3-4	D
	12	1	H6, H13	9.4.5.1.4	3-4	A
	13	1	H6, H9	9.3.2.2.2	4-5	B
	14	1	H10	9.3.4.1.7	2-3	C
	15	1	H10	9.3.1.1.3	3-4	C
Part B- Free response	16	4	H6, H13	9.2.2.1.6, 9.2.2.2.6	2-3	
	17	4	H6, H11, H12, H13, H14	9.2.1.2.1	4-6	
	18	3	H3, H4, H13	9.2.2.2.3	2-4	
	19	2	H9	9.3.4.1.1	2-4	
	20	7	H6, H13	9.2.3.1.6	4-6	
	21	5	H10, H13	9.3.1.2.6	2-6	
	22	5	H13, H15	9.1	4-6	
	23	3	H6, H9, H11, H13	9.1, 9.3.4.1.5	2-6	
	24	6	H6, H9, H13	9.3.2.2.1	2-6	
	25	5	H4, H5, H9, H13, H16	9.3.5.2.1	2-6	
	26	7	H1, H3, H4, H13, H14	9.4.3.1.2, 9.4.3.2.2, 9.4.2.1.3	2-6	
	27	3	H6, H8, H13	9.4.4.2.1	3-5	
	28	2	H6, H9, H13	9.3.2.1.3, 9.3.3.1.1, 9.3.3.1.7, 9.3.4.2.2	2-6	
	29	4	H6, H13	9.4.5.1.2	3-6	
Part II Option 1	30a	3	H6	9.5.1.1.1	2-4	
	30b	4	H6, H13	9.5.2.1.1	2-4	
	30c	7	H6, H13, H14	9.1, 9.5.3.1.1, 9.5.3.1.1	4-6	

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	30d	8	H1, H6	9.5.6.2.1	3-6	
	30e	3	H6	9.5.7.1.1, 9.5.7.1.2, 9.5.7.2.2	2-4	
Exam Section	Question	Marks	Syllabus/Course outcomes	Content	Targeted performance band	Answer
Part II Option 2	31a	4	H1, H3, H4, H13, H14	9.6.1.2.2, 9.6.1.1.2	2-5	
	31b	6	H1, H3, H6	9.6.3.2.1, 9.6.3.2.2	3-5	
	31c	5	H6, H12, H13	9.1, 9.6.2.2.1	3-6	
	31d	2	H3, H9, H13	9.6.6.1.3	3-5	
	31e	8	H3, H9, H13, H16	9.6.5.1.2, 9.6.6.1.2, 9.6.6.1.3	3-6	
Part II Option 3	32a	1	H9	9.7.2.1.1	2-3	
	32b	4	H4, H9, H13	9.7.2.2.1, 9.7.2.1.4	3-5	
	32c	8	H12, H13, H14	9.1, 9.7.6.1.2	3-6	
	32d	4	H9	9.7.8.1.3	4-6	
	32e	8	H1, H3, H4	9.7.5.2.1	3-6	
Part II Option 4	33a	6	H1, H11, H13	9.8.1.1.2, 9.8.1.1.3, 9.8.1.1.3	2-5	
	33b	7	H6, H10, H12, H13, H14	9.1, 9.8.2.1.5	3-6	
	33c	7	H3, H10, H13	9.8.2.1.6	3-6	
	33d	5	H10, H13, H14	9.8.5.1.1, 9.8.5.2.1	3-6	
Part II Option 5	34a	6	H1, H6, H13	9.9.3, 9.9.8.1.1	2-4	
	34b	7	H1, H6, H11, H12, H13	9.1, 9.9.2.1.3, 9.9.3.2.1	3-6	
	34c	8	H1, H3, H6, H13	9.9.5.2.1, 9.9.8.2.1	4-6	
	34d	4	H6, H13	9.9.7.2.1, 9.9.7.1.1	3-6	

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**2008 TRIAL HIGHER SCHOOL CERTIFICATE
EXAMINATION**

BIOLOGY – MARKING GUIDELINES

The sample answers indicate features that should be found in a response that receives full marks. For the extended response questions, a set of guidelines is included rather than a sample answer.

Section I

Part A – 15 marks

Questions 1-15 (1 mark each)

Question	Correct Response	Outcomes Assessed	Targeted Performance Bands
1	A	H6	2-3
2	C	H6	4-5
3	B	H6	2-3
4	C	H6	4-5
5	A	H13	3-4
6	D	H9	2-3
7	C	H9, H13	3-4
8	B	H6, H13	2-3
9	B	H6	3-4
10	B	H6	2-3
11	D	H6	3-4
12	A	H6, H13	3-4
13	B	H6, H9	4-5
14	C	H10	3-4
15	C	H10	4-5

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Section I
75 marks

Part B – 60 marks

Question 16 (4 marks)

(a) (1 mark)

Outcomes Assessed: H6, H13

Targeted Performance Bands: 2-3

Criteria	Mark
Correctly identifies tissue 1 and tissue 2.	1

Sample answer

Tissue 1 is xylem and tissue 2 is phloem.

(b) (1 mark)

Outcomes Assessed: H6, H13

Targeted Performance Bands: 2-3

Criteria	Mark
Correctly identifies Tissue B and the substance transported by this tissue.	1

Sample answer

Tissue B is xylem and water and dissolved mineral ions are transported.

(c) (2 marks)

Outcomes Assessed: H6, H13

Targeted Performance Bands: 3-4

Criteria	Marks
Correctly describes theory.	2
Correctly identifies theory.	1

Sample answer

The transpiration – cohesion – tension mechanism accounts for the ascent of water in the xylem. Water is mainly pulled by transpiration, cohesion sticks water molecules together and water molecule also adhere to the walls of the xylem.

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Question 17 (4 marks)**Outcomes Assessed: H6, H11, H12, H13, H14****Targeted Performance Bands: 4-6**

Criteria	Marks
Includes in method the following points: Equal volume and concentration of gelatine solution, equal volume and concentration of bromelain used, bromelain heated to different temperatures, timed rate of setting, repetition of experiment.	4
Includes 3 or 4 of the above points.	2-3
Includes 2 of the above points.	1

Sample answer

Place 10mL of gelatin solution into 5 test tubes.

Heat 5 x 2mL samples of fresh pineapple juice to 20, 40, 60, 80, 100 °C

Add the heated samples above into each of the labeled test tubes containing gelatin solution.

Time how long it takes for the gelatine to set in each test tube.

Repeat 5 times.

Question 18 (3 marks)**Outcomes Assessed: H3, H4, H13****Targeted Performance Bands: 4-5**

Criteria	Marks
- Identify a current technology that measure levels of oxygen in the blood. - Using a specific example explains why the technology is used.	3
- Identify a current technology that measure levels of oxygen in the blood and identifies why the technology is used, OR - Using a specific example explains why the technology is used.	2
One of the above points.	1

Sample answer

The Pulse Oximeter is a current technology that measure levels of oxygen in the blood. This may be used to measure the oxygen in the blood of asthmatics where bronchioli are constricted to ensure that enough oxygen is getting to tissues.

Question 19 (2 marks)**Outcomes Assessed: H9****Targeted Performance Bands: 2-4**

Criteria	Marks
All 6 in correct sequence.	2
Any 3 in correct sequence.	1

Sample answer

CADFBC

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Question 20 (7 marks)**Outcomes Assessed:** H6, H13**Targeted Performance Bands:** 4-6

Criteria	Marks
- Identifies the role of filtration. - Explains why glucose is not found in urine. - Explains why urea and sodium ions are found in greater concentrations in urine compared with glomerular filtrate. - Explains why urea and sodium ions are not reabsorbed.	6-7
- Identifies the role of filtration. - Explains why glucose is not found in urine. - Identifies that urea and sodium ions are found in greater concentrations in urine compared with glomerular filtrate. - Identifies that urea and sodium ions are not reabsorbed.	4-5
- Identifies the role of filtration. - Identifies why glucose is not found in urine. - Identifies that urea and sodium ions are found in greater concentrations in urine compared with glomerular filtrate. - Identifies that urea and sodium ions are not reabsorbed.	2-3
2 of the above points.	1

Sample answer

Sodium ions, glucose and urea are removed from the blood by glomerular filtration. Glucose is totally reabsorbed in the proximal tubule of the nephron by active transport which accounts for its absence in urine. Urea is not reabsorbed as it is a toxic waste substance and its concentration increases as it passes along the nephron as water is reabsorbed into the blood by osmosis. The concentration of sodium ions increases as water is reabsorbed into the blood. Sodium ions are not reabsorbed if they are in excess to the body's requirements.

Question 21 (5 marks)

(a) 1 mark

Outcomes Assessed: H10, H13**Targeted Performance Bands:** 2-4

Criteria	Mark
Relate structure to common ancestor.	1

Sample answer

The whale and the human hand are similar structures that have been derived from a common ancestor.

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Question 21 (continued)

(b) (4 marks)

Outcomes Assessed: H10, H13**Targeted Performance Bands: 4-6**

Criteria	Marks
Defines the theory of evolution; uses an example of a line of evidence and describes how this supports the theory of evolution.	3-4
- Name a line of evidence and describe how this supports the theory of evolution, OR - Uses an example and describe how this supports the theory of evolution.	2-3

Sample answer

Biochemistry, for example, DNA-DNA hybridisation, supports the theory of evolution as it allows a comparison of the DNA of different organisms. Species that share a recent common ancestor have more DNA in common than other organisms.

Question 22 (2 marks)**Outcomes Assessed: H9, H13****Targeted Performance Bands: 2-3**

Criteria	Marks
Correctly links all four scientists to contributions.	2
Correctly links two or three scientists to contributions.	1

Sample answer

Scientist(s)	Contribution
Sutton and Boveri	Chromosomal theory of inheritance
Morgan	Sex linkage
Beadle and Tatum	One gene – one protein hypothesis
Mendel	Independent monohybrid cross.

Question 23 (3 marks)

(a) (1 mark)

Outcomes Assessed: H6, H9, H13**Targeted Performance Bands: 2-4**

Criteria	Mark
Correctly defines mutation.	1

Sample answer

A mutation is a change in the DNA sequence on a chromosome.

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Question 23 (continued)

(b) (1 mark)

Outcomes Assessed: H9, H11, H13**Targeted Performance Bands:** 4-5

Criteria	Mark
Correctly identifies the control.	1

Sample answer

The group of plants that did not receive any radiation was the control.

(c) (1 mark)

Outcomes Assessed: H9, H14**Targeted Performance Bands:** 5-6

Criteria	Mark
Correctly states a conclusion.	1

Sample answer

Increased levels of radiation causes a decrease in the numbers of seeds germinating.

Question 24 (6 marks)

(a) (2 marks)

Outcomes Assessed: H6, H9, H13**Targeted Performance Bands:** 2-6

Criteria	Marks
Correctly explains the inheritance pattern shown.	2
Correctly identifies the inheritance pattern shown.	1

Sample answer

The inheritance of familial emphysema is recessive. Individuals 7 and 8 do not show the characteristic but their child (13) does. Both 7 and 8 must be heterozygous and the recessive allele is not expressed in their phenotype.

(b) (2 marks)

Outcomes Assessed: H9, H13**Targeted Performance Bands:** 2-6

Criteria	Marks
Identifies the genotypes of both individuals.	2
Identifies the genotype of one individuals.	1

Sample answer

F= normal f= familial emphysema

Individual 1 is Ff

Individual 4 is ff

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Question 24 (continued)

(c) (2 marks)

Outcomes Assessed: H9**Targeted Performance Bands:** 2-6

Criteria	Marks
Determines correct percentage showing calculations.	2
Determines correct percentage without showing calculations.	1

Sample answer

50% of their children might/could suffer familial emphysema.

	F	f
f	Ff	ff
f	Ff	ff

Question 25 (5 marks)

(a) (1 mark)

Outcomes Assessed: H9, H13**Targeted Performance Bands:** 2-6

Criteria	Mark
Correctly identifies the name given to a species that has had genes of a different organism added to their genetic makeup.	1

Sample answer

Transgenic organism.

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Question 25 (continued)

(b) (4 marks)

Outcomes Assessed: H4, H5, H6, H13**Targeted Performance Bands: 3-6**

Criteria	Marks
- Provides 2 ethical arguments for and 2 against the use of transgenic species. - Provides examples.	3-4
- Provides 1 ethical argument for and 1 against the use of transgenic species with examples, OR - Provides 2 arguments for and 2 against the use of transgenic species without examples.	1-2

Sample answer

The use of transgenic species creates ethical debate with both positive and negative aspects of their use being evident.

The use of transgenic species such as Bt cotton is advantageous as it reduces the necessity for pesticides and therefore causes less impact on the environment. Bacteria can be used to produce hormones such as human insulin which has fewer side effects when used by a diabetic.

Transgenic Bt cotton is a living organism that has been patented for the benefit of large multinational companies, not for the benefit of all. The Oncomouse was engineered to contain the human cancer gene and is used in research programs to search for a cure for human cancer. The Oncomouse only lives for 8 weeks before it dies from cancer.

Question 26 (7 marks)

(a) (1 mark)

Outcomes Assessed: H13**Targeted Performance Band: 2-3**

Criteria	Mark
Correctly defines pathogen.	1

Sample answer

A pathogen is a disease causing organism.

(b) (1 mark)

Outcomes Assessed: H13**Targeted Performance Band: 2-3**

Criteria	Mark
Protozoan.	1

Sample answer

Protozoan

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Question 26 (continued)

(c) (2 marks)

Outcomes Assessed: H7, H13**Targeted Performance Bands: 2-4**

Criteria	Marks
Identifies 2 distinguishing features of protozoan.	2
Identifies 1 distinguishing feature of protozoan.	1

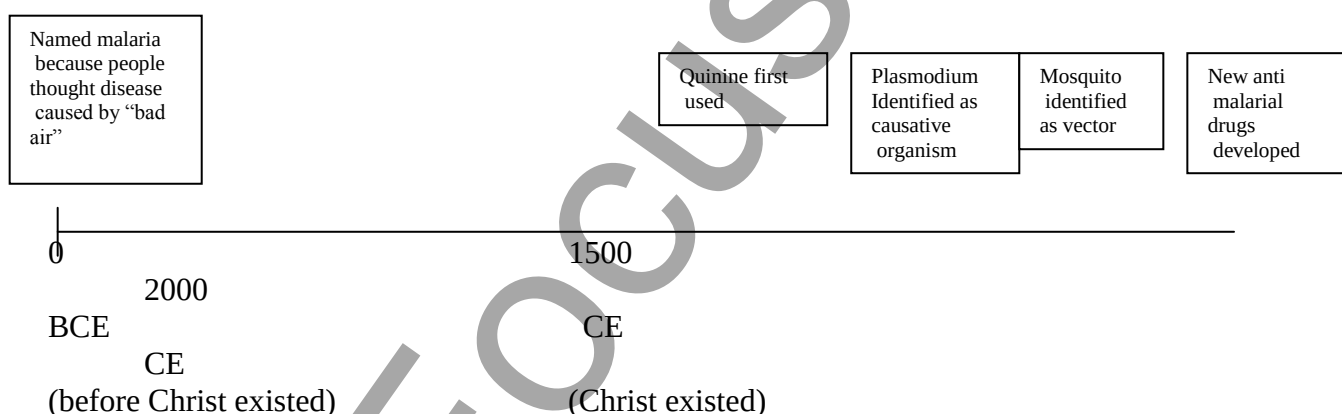
Sample answer

Single cell, eukaryotic, may have flagella.

(d) (3 marks)

Outcomes Assessed: H1, H3, H4, H13, H14**Targeted Performance Bands: 4-6**

Criteria	Marks
Includes 3-5 relevant developments placed on a suitable time line.	2-3
Includes 2 developments in the appropriate chronological sequence.	1

Sample answer**Question 27 (3 marks)**

(a) (3 marks)

Outcomes Assessed: H6, H8, H13**Targeted Performance Band: 3-5**

Criteria	Marks
Describes how an imbalance of microflora may result in thrush.	2-3
Identifies how an imbalance of microflora may result in thrush.	1

Sample answer

Bacteria and our immune system normally keep yeast numbers under control but with prolonged use of antibiotics or immune suppression, the population of beneficial bacteria is reduced. This causes an upset in the balance of microflora, allowing the yeast to proliferate, resulting in thrush.

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Question 28 (5 marks)

Outcomes Assessed: H13, H15

Targeted Performance Bands: 4-6

Criteria	Marks
• Provide examples of an investigation undertaken by a team and by an individual. • Using the above examples, gives advantages and disadvantages of both team and individual research.	5
• Provide examples of an investigation undertaken by a team and by an individual. • Gives general advantages and disadvantages of both team and individual research unrelated to example given.	3-4
• Gives general advantage and one disadvantage of both team and individual research, OR • Provide examples of an investigation undertaken by a team and by an individual.	1-2

Sample answer

Scientific discoveries are rarely the work of one person but tend to result from teams of people bringing together different skills. These teams may be working together or may be scattered all over the world working independently in different laboratories. Determining the structure of DNA is a good case study exemplifying both the role of collaboration and effective communication in scientific research. The work of Mendel on patterns of inheritance is an example of an individual who worked successfully by himself.

The four main people working on the 3D structure of the DNA molecule were Rosalind Franklin and Maurice Wilkins from King's College London and James Watson and Francis Crick from Cambridge University. Watson constructed a physical model with nitrogen bases facing inwards. Crick solved the mathematical equations that governed the helical model. Wilkins discovered that it was possible to produce thin threads of DNA suitable for X-ray diffraction. Franklin worked on X-ray diffraction of DNA and showed that DNA had the characteristics of a helix.

The expertise of the individuals was not enough to solve the problem of the structure of DNA, but the collaboration of Wilkins, Watson and Crick resulted in the current model. The disadvantage of this team approach was the controversy associated with the lack of communication between the groups.

Mendel worked as an individual and in doing so was able to control his experimental procedures. Morgan also worked on his own – very successfully. However, the work took many years and ultimately was accepted by the scientific community.

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Question 29 (4 marks)

(a) (2 marks)

Outcomes Assessed: H6, H13

Targeted Performance Band: 3-5

Criteria	Marks
• Correctly describes the role of both cells.	2
• Correctly describes the role of one cell or identifies the role of both cells.	1

Sample answer

Killer T-cells attack and destroy macrophages that have engulfed an antigen. They produce cytotoxins. Suppressor T-cells help to turn off the immune response after an infection has been controlled.

Question 29 (continued)

(b) (2 marks)

Outcomes Assessed: H6, H13

Targeted Performance Band: 5-6

Criteria	Marks
• Correctly describes one interaction between B and T lymphocytes.	2
• Correctly identifies one interaction between B and T lymphocytes.	1

Sample answer

B and T lymphocytes interact as they are both attacking the same antigen. Helper T cells stimulate B cells and T cells to clone.

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OPTION 1

Question 30 - COMMUNICATION (25 marks)

(a) (i) (1 mark)

Outcomes Assessed: H6

Targeted Performance Bands: 2-3

Criteria	Mark
• Identifies the role of receptors.	1

Sample answer

Receptors detect a stimulus.

(a) (ii) (2 marks)

Outcomes Assessed: H6, H13

Targeted Performance Bands: 2-4

Criteria	Marks
• Correctly shows the steps involved on the stimulus-response pathway in a flow chart.	2
• Shows 2-3 steps in the stimulus-response pathway in a flow chart.	1

Sample answer

Stimulus → receptor → coordinating centre → effector → response.

(b) (4 marks)

Outcomes Assessed: H6, H13

Targeted Performance Bands: 2-4

Criteria	Marks
• Correctly explains the function of 3-4 structures.	3-4
• Correctly explains the function of 1-2 structures.	1-2

Sample answer

Structure	Function
Conjunctiva	Protects and nourishes the cornea
Choroid	Nourishes retina and prevents internal reflection
Lens	Focuses light onto the retina
Optic nerve	Carries impulses to the vision centre of the brain

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Question 30 (continued)

(c) (i) (1 mark)

Outcomes Assessed: H6**Targeted Performance Bands: 2-4**

Criteria	Mark
Identifies correct relationship between nerves, neuronal fibres and nerve cells.	1

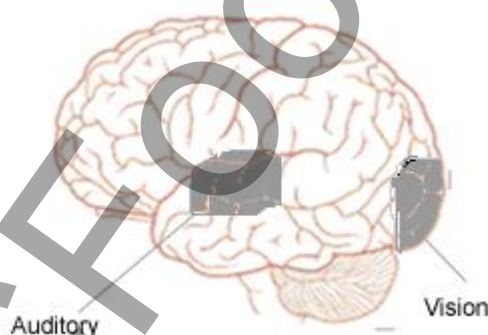
Sample answer

A nerve is a bundle of axons and dendrites or neuronal fibres. A neurone is a nerve cell.

(c) (ii) (2 marks)

Outcomes Assessed: H6**Targeted Performance Bands: 2-4**

Criteria	Marks
Correctly identifies location of areas involved in perception of light and sound using a drawing.	2
Correctly identifies location of areas involved in perception of light or sound using a drawing.	1

Sample answer

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Question 30 (continued)

Without our increased knowledge of the structure and function of the ear and the diseases that impair hearing, it would not have been possible to develop technologies to improve auditory function.

(c) (i) (1 mark)

Outcomes Assessed: H6

Targeted Performance Bands: 2-4

Criteria	Mark
• Identifies correct relationship between nerves, neuronal fibres and nerve cells.	1

Sample answer

A nerve is a bundle of axons and dendrites or neuronal fibres. A neurone is a nerve cell.

(c) (ii) (2 marks)

Outcomes Assessed: H6

Targeted Performance Bands: 2-4

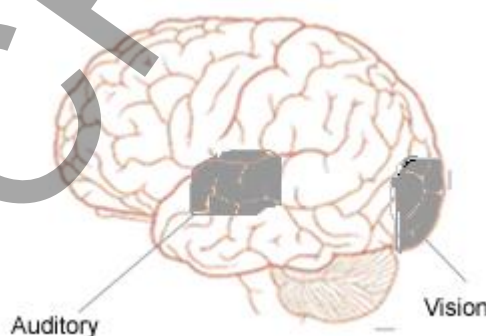
Criteria	Marks
• Correctly identifies location of areas involved in perception of light and sound using a drawing.	2
• Correctly identifies location of areas involved in perception of light or sound using a drawing.	1

Sample answer

Back
occipital lobe

Front

Temporal lobe



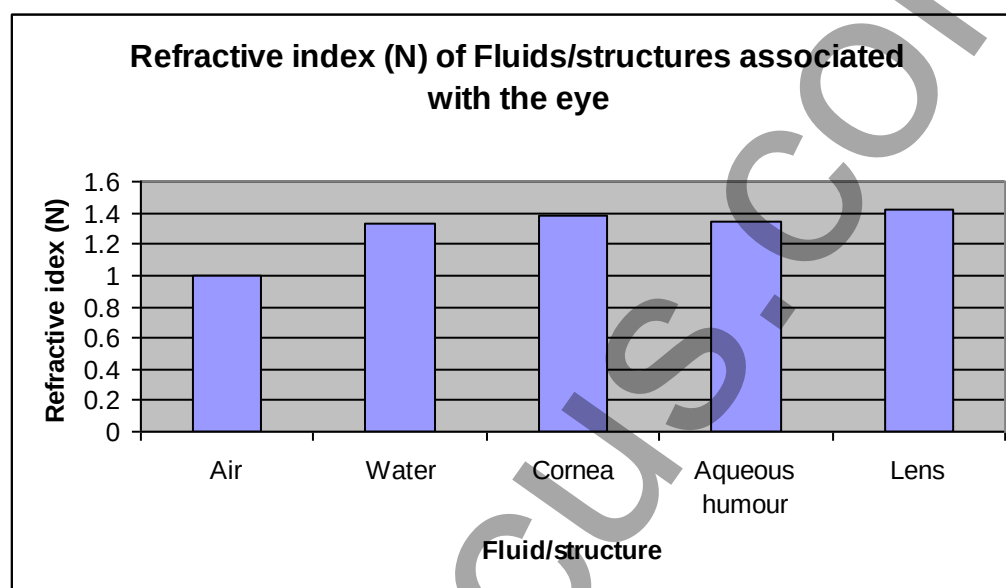
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Question 30 (continued)

(d) (i) (4 marks)

Outcomes Assessed: H6, H13**Targeted Performance Bands:** 3-6

Criteria	Marks
• Data graphed as a column graph, correctly labelled x and y axis with correct units, scale and points plotted accurately.	3-4
• 2-3 of the above points demonstrated.	1-2



(d) (ii) (1 mark)

Outcomes Assessed: H6, H12, H13**Targeted Performance Bands:** 3-6

Criteria	Mark
• Refraction defined correctly.	1

Sample answer

Refraction is the bending of light rays.

(d) (iii) (2 marks)

Outcomes Assessed: H6, H13, H14**Targeted Performance Bands:** 4-6

Criteria	Marks
• Identifies the correct refraction of light as it passes through cornea and relates this to the change in density.	2
• Identifies one of the above points.	1

Sample answer

As a ray of light passes from air into the cornea it bends towards the normal because the cornea is denser than air.

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Question 30 (continued)

(e) (8 marks)

Outcomes Assessed: H1, H6**Targeted Performance Bands: 3-6**

Criteria	Marks
Discusses type of knowledge needed to develop technologies. Uses more than one example of a technology related to auditory function including knowledge specific to that example, and explains how the technology improves auditory function.	7-8
- Discusses type of knowledge needed to develop technologies. Uses more than one example of a technology related to auditory function including knowledge specific to that example, and identifies how the technology improves auditory function, OR - Discusses type of knowledge needed to develop technologies. Uses one example of a technology related to auditory function including knowledge specific to that example, and explains how the technology improves auditory function.	5-6
Outlines type of knowledge needed to develop technologies. Uses one or more examples of a technology related to auditory function including knowledge specific to that example, and identifies how the technology improves auditory function.	3-4
Identifies type of knowledge needed to develop technologies. Uses one example of a technology related to auditory function including knowledge specific to that example, and identifies how the technology improves auditory function.	1-2

Sample answer

Technologies currently used to improve auditory function are the hearing aid and a cochlear implant. The development of these technologies required knowledge of the structure and function of parts of the ear and the causes of deafness.

Developing the hearing aid, required a knowledge of the function of the middle ear ie ear drum and ear ossicles. This resulted in the production of a device that amplifies sound to compensate for poor movement of the ear drum or ossicles.

The development of the cochlear implant relied upon the knowledge that sensoro-neural deafness was due to a problem related to the inner ear (cochlear) and not the middle ear. Knowledge was also needed of the location of the nerve cells in the cochlear. This knowledge led to the development of electrodes, which when implanted, directly stimulate the receptors within the cochlear allowing the production of an impulse that can be sent to the auditory centre of the brain.

Without our increased knowledge of the structure and function of the ear and the diseases that impair hearing, it would not have been possible to develop technologies to improve auditory function.

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OPTION 2

Question 31 - BIOTECHNOLOGY (25 marks)

(a) (i) (1 mark)

Outcomes Assessed: H3, H4

Targeted Performance Bands: 2-3

Criteria	Mark
• Correctly outlines one Australian use of biotechnology.	1

Sample answer

Aboriginals built canals connected to swamps to make it easier to trap eels.

(a) (ii) (3 marks)

Outcomes Assessed: H3, H13, H14

Targeted Performance Bands: 2-5

Criteria	Marks
• Define biotechnology and using an appropriate example, justify the use of this term when discussing agricultural practices used 10000 years ago.	2-3
• Define biotechnology OR uses an appropriate example to outline the use of this term when discussing agricultural practices used 10000 years ago.	1

Sample answer

Biotechnology, defined as the application of scientific knowledge to use living organisms to make or modify a product, improve plants or animals and utilise microorganisms for specific purposes. This has been part of the development of human culture. The first examples of biotechnology came through the domestication of plants, such as the collection of wild seeds of barley and wheat in Iraq, which were then used for cultivation.

(b) (i) (2 marks)

Outcomes Assessed: H3, H6

Targeted Performance Bands: 3-5

Criteria	Marks
• Correctly outlines the role of yeast in the fermentation process.	2
• Identifies the role of yeast in the fermentation process.	1

Sample answer

Yeast is a single-celled organism that uses sugar for fermentation. If it is encouraged to do this in the absence of oxygen it releases two waste products: carbon dioxide and ethyl alcohol or ethanol.

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Question 31 (continued)

(b) (ii) (4 marks)

Outcomes Assessed: H1, H3**Targeted Performance Bands: 3-6**

Criteria	Marks
• Correctly describes how 2 changes in technology and scientific knowledge have modified the traditional uses of biotechnology.	3-4
• Outlines how 1-2 changes in technology and scientific knowledge have modified the traditional uses of biotechnology.	1-2

Sample answer

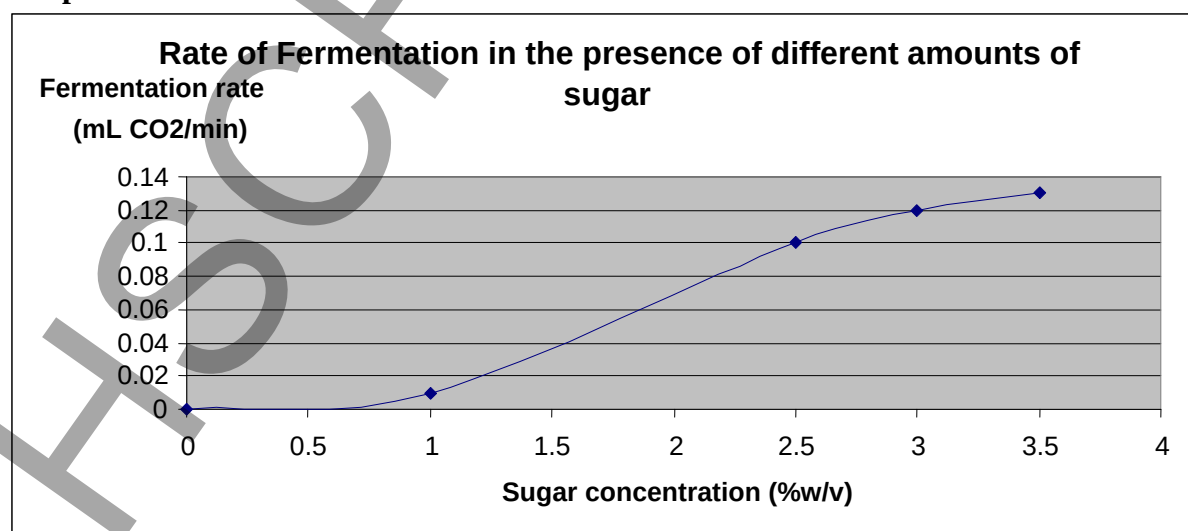
With the increased knowledge of microorganisms and their nutrient requirements, strain isolation methods were developed. By selecting various nutrients in the growth medium, specific strains of microorganism could be isolated, cultured and studied. This led to the commercial development of penicillin.

An increased knowledge of microorganisms and their metabolic processes led to biotransformation techniques. Biotransformation is the process where one chemical is changed into another by a chemical reaction that occurs in a living organism. This ability is part of an organism's metabolism. The adding of a fluorine atom to a steroid hormone which makes it significantly more effective.

(c) (i) (4 marks)

Outcomes Assessed: H12, H13**Targeted Performance Bands: 3-6**

Criteria	Marks
• Data graphed as a line graph, correctly labelled x and y axis with correct units, scale and points plotted accurately.	3-4
• 2-3 of the above points demonstrated.	1-2

Sample answer

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Question 31 (continued)

(c) (ii) (1 mark)

(Outcomes Assessed: H6, H12, H13)**Targeted Performance Bands: 3-4**

Criteria	Mark
• Correct prediction made.	1

Sample answer0.14mL Co²/min

(d) (2 marks)

(Outcomes Assessed: H3, H9, H13)**Targeted Performance Bands: 3-5**

Criteria	Marks
• Correctly describes the role of biotechnology in the production of monoclonal antibodies.	2
• Correctly outlines the role of biotechnology in the production of monoclonal antibodies.	1

Sample answer

Monoclonal antibodies are produced by fusing B-cells with cells that will continue to replicate usually harmless tumor cells. The result of this cell fusion is called a hybridoma. The hybridoma can then continue to produce antibodies in culture as long as they are needed.

(e) (8 marks)

(Outcomes Assessed: H3, H9, H13, H16)**Targeted Performance Bands: 3-6**

Criteria	Marks
• Defines biotechnology and describes the process of recombinant DNA technology. Describes the knowledge required for the development of this technology, using examples. Relates the importance of the increase of knowledge to the development of technology.	7-8
• Defines biotechnology. Describes the knowledge required for the development of this technology, using examples. Generally relates the importance of the increase of knowledge to the development of technology.	5-6
• Defines biotechnology. Outlines the knowledge required for the development of this technology, using examples. Simply relates the importance of the increase of knowledge to the development of technology.	3-4
• Defines biotechnology or simply outlines the process of recombinant DNA technology, AND/OR • Identifies the knowledge required for the development of this technology, using examples.	1-2

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Question 31 (continued)

Sample answer

Recombinant DNA technology (also known as genetic engineering) was developed in the 1980's. This form of technology involves the transfer of genes from one organism to another. The resulting organism is called transgenic. The new gene instructs the host cell to produce a desired commercial or medical product.

The development of this technology required a knowledge of :

- The structure of the DNA molecule.
- The location of specific genes in the molecule eg the human insulin gene.
- The identification of enzymes necessary to cut out the required gene (human insulin gene) from donor DNA (restriction enzymes).
- Knowledge of the process of DNA replication and its manipulation for PCR.
- The identification of enzymes necessary to rejoin the pieces of DNA (ligases) eg placing the human insulin gene in a bacterial plasmid).
- Knowledge of possible methods of transfer (use of bacterial plasmids, viruses vectors and microinjection).

In the case of the production of human insulin, the recombinant DNA technology produces a transgenic bacteria which can then be used to produce human insulin for diabetics.

This would not have been possible without an increase in our knowledge of DNA.

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OPTION 3**Question 32 - GENETICS - THE CODE BROKEN?**

(a) (1 mark)

Outcomes Assessed: H9**Targeted Performance Bands: 2-3**

Criteria	Mark
Correctly identifies 2 examples of characteristics determined by multiple alleles in an organism other than a human.	1

Sample answer

Drosophila-eye colour (red/white/vermillion).

Coat colour in mice (yellow/agouti/black).

(b) (i) (1 mark)

Outcomes Assessed: H4, H9, H13**Targeted Performance Bands: 3-5**

Criteria	Mark
Correctly identifies which male could be the father.	1

Sample answer

Male with type B blood.

(b) (ii) (1 mark)

Outcomes Assessed: H12, H13, H14**Targeted Performance Bands: 3-6**

Criteria	Mark
Correctly explains if it is possible to eliminate either of the men based on blood type analysis.	1

Sample answer

It is possible to eliminate the male with type AB blood. The child is type O therefore he/she must have received an O allele from both parents and this is only possible in the father with type B blood.

Question 32 (continued)

(b) (iii) (2 marks)

Outcomes Assessed: H9**Targeted Performance Bands: 4-6**

Criteria	Marks
• Explain the role of highly variable genes for DNA fingerprinting and relates to the example above.	2
• Outlines the role of highly variable genes for DNA fingerprinting and relates to the example above.	1

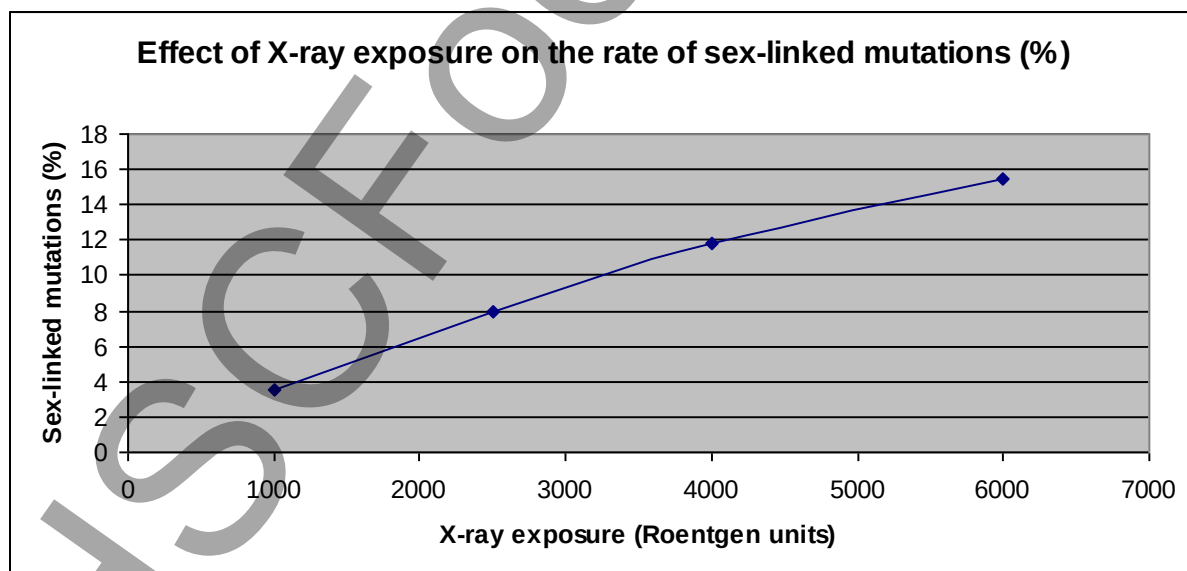
Sample answer

Parts of DNA contain repetitive non-coding sequences. In different people eg: the 2 possible fathers, these sequences vary considerably in the numbers of the repeating units. Using the technique of DNA fingerprinting, these natural can be used to distinguish between the 2 fathers.

(c) (i) (4 marks)

Outcomes Assessed: H12, H13**Targeted Performance Bands: 3-6**

Criteria	Marks
• Data graphed as a line graph, correctly labelled x and y axis with correct units, scale and points plotted accurately.	3-4
• 2-3 of the above points demonstrated.	1-2

Sample answer

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Question 32 (continued)

(c) (ii) (1 mark)

Outcomes Assessed: H14**Targeted Performance Bands: 3-4**

Criteria	Mark
• Correct prediction made.	1

Sample answer

17%

(c) (iii) (3 marks)

Outcomes Assessed: H9, H13**Targeted Performance Bands: 3-4**

Criteria	Marks
• Correctly outlines the ability of DNA to repair itself.	2-3
• Correctly identifies the ability of DNA to repair itself.	1

Sample answer

Mutations or mistakes in the copying of the DNA are common and cells contain mechanisms to repair these mistakes. Copying errors can be repaired by enzymes such as DNA polymerase that can use the undamaged strand of DNA in the double helix as a template to fix and replace the incorrect damaged base sequence.

(d) (4 marks)

Outcomes Assessed: H9**Targeted Performance Bands: 4-6**

Criteria	Marks
• Correctly defines gene homologues and their functions and provides evidence of their presence in lower animal classes.	3-4
• Correctly defines gene homologues and their functions, OR provides evidence of their presence in lower animal classes.	1-2

Sample answer

DNA sequences that code for the same function in many organisms are called homologue genes, homeobox or Hox genes. These genes regulate the development of an organism by producing proteins that switch other genes on and off.

An example of a homologue is the gene cascade for skeletal and neurological development in limbs. The same pattern of Hox genes is similar in organisms such as humans, chickens, insects, and molluscs. A mammal homologue gene can regulate the corresponding gene in insects such as fruit flies.

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Question 32 (continued)

(e) (8 marks)

Outcomes Assessed: H1, H3, H4**Targeted Performance Bands: 3-6**

Criteria	Marks
Defines gene therapy and describes the process of recombinant DNA technology. Describes the knowledge required for the development of this technology, using examples. Relates the importance of the increase of knowledge to the development of technology.	7-8
Defines gene therapy. Describes the knowledge required for the development of this technology, using examples. Generally relates the importance of the increase of knowledge to the development of technology.	5-6
Defines gene therapy. Outlines the knowledge required for the development of this technology, using examples. Simply relates the importance of the increase of knowledge to the development of technology.	3-4
- Defines gene therapy or simply outlines the process of recombinant DNA technology, AND/OR - Identifies the knowledge required for the development of this technology, using examples.	1-2

Sample answer

Gene therapy is the application of genetic engineering techniques to supplement 'harmful genes'. The techniques were originally developed to identify and supplement abnormal genes such as those causing diseases such as cystic fibrosis.

Gene therapies for cystic fibrosis are in the experimental stage and rely on gene delivery vectors that can enter a large number of cells and integrate their engineered DNA into the host cell's chromosomes. An adenovirus is used to deliver the properly functioning gene to cells lining the respiratory tract.

The development of this technology required a knowledge of :

- The structure of the DNA molecule.
- The location of specific genes in the molecule eg the CFTR gene.
- The identification of enzymes necessary to cut out the required gene from donor DNA (restriction enzymes).
- Knowledge of the process of DNA replication and its manipulation for PCR.
- The identification of enzymes necessary to rejoin the pieces of DNA (ligases)
- Knowledge of possible methods of transfer (use of bacterial plasmids, viruses vectors and microinjection).

In the case of the cystic fibrosis, the gene therapy technology delivers a properly functioning gene which can then be used by the host cell and reduce the symptoms of cystic fibrosis. Even though this technology is still in an experimental stage it would not have been possible without an increase in our knowledge of DNA.

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OPTION 4**Question 33 - HUMAN STORY (25 marks)**

(a) (i) (2 marks)

Outcomes Assessed: H1, H13**Targeted Performance Bands: 2-5**

Criteria	Marks
• Correct explanation of the term species including both reproductive capabilities and a common gene pool.	2
• Correct explanation of the term species including either reproductive capabilities OR a common gene pool.	1

Sample answer

In general the criteria used to identify a species is if two organisms can breed together and form fertile offspring and they share a common gene pool, then they are considered to be the same species.

(a) (ii) (2 marks)

Outcomes Assessed: H11, H13**Targeted Performance Bands: 2-5**

Criteria	Marks
• Outline 2 correct features of a mammal that classify humans as mammalian and 2 correct primate features that classify humans as primates.	2
• Outline 2 correct features of a mammal that classify humans as mammalian or 2 correct primate features that classify humans as primates, OR • Outline 1 correct feature of a mammal that classify humans as mammalian and 1 correct primate feature that classify humans as primates.	1

Sample answer

The mammalian features of humans are: *hair, mammary glands, three separate bones in the inner ear, four-chambered heart and a lower jaw consisting of one bone.*

The primate features of humans include: *fingernails and toe-nails, an opposable thumb, stereoscopic (binocular) vision, a relatively large brain, a flattened face with a reduced sense of smell and forward facing eyes, ridged finger pads, two nipples and a prolonged period of care for the young.*

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Question 33 (continued)

(a) (iii) (2 marks)

Outcomes Assessed: H1, H13**Targeted Performance Bands:** 2-5

Criteria	Marks
• Correctly explains the relationship between hominid and hominin.	2
• Correctly outlines the relationship between hominid and hominin.	1

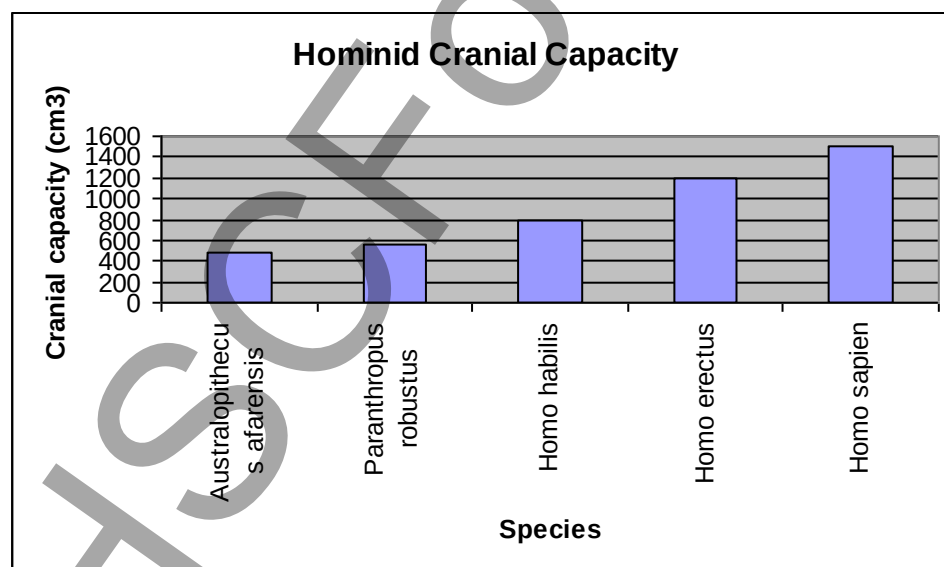
Sample answer

The use of the terms *hominid* and *hominin* is undergoing change, as new evidence becomes available from biochemical and genetic sources. Hominids used to be a group containing modern humans (*Homo sapiens*) and their close relatives. Recent evidence has shown that African apes including chimpanzees and gorillas are genetically very similar to *Homo sapiens* and should be grouped with them as hominids. Living humans and their ancestors since the split from the apes are called hominins.

(b) (i) (4 marks)

Outcomes Assessed: H12, H13**Targeted Performance Bands:** 3-6

Criteria	Marks
• Data graphed as a column graph, correctly labelled x and y axis with correct units, scale and points plotted accurately.	3-4
• 2-3 of the above points demonstrated.	1-2

Sample answer

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Question 33 (continued)

(b) (ii) (1 mark)

Outcomes Assessed: H6, H12, H13**Targeted Performance Bands:** 3-4

Criteria	Mark
Correct relationship outlined.	1

Sample answer

As cranial capacity increased, the cultures became more complex.

(b) (iii) (2 marks)

Outcomes Assessed: H10, H12, H13, H14**Targeted Performance Bands:** 4-6

Criteria	Marks
2 difficulties in interpretation discussed.	2
2 difficulties in interpretation identified, OR 1 difficulty in interpretation discussed.	1

Sample answer

There is a conflict in dates for fossils based on the use of different technologies. There are gaps in the fossil record which makes it difficult to establish clear evolutionary pathways and relationships.

(c) (7 marks)

Outcomes Assessed: H3, H10, H13**Targeted Performance Bands:** 3-6

Criteria	Marks
Describes at least 3 technologies used to study relationships between organisms, using examples. Describes the knowledge required for the development of this technology. Relates the importance of the increase of knowledge to the development of technology.	6-7
Describes at least 1-2 technologies used to study relationships between organisms, using examples. Describes the knowledge required for the development of this technology. Relates the importance of the increase of knowledge to the development of technology.	4-5
Identifies at least 2 technologies used to study relationships between organisms, using examples. Identifies the knowledge required for the development of this technology. Relates the importance of the increase of knowledge to the development of technology.	2-3
- Identifies at least 1 technology used to study relationships between organisms, using an example, OR - Identifies 1 piece of knowledge required for the development of this technology.	1

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Question 33 (continued)

Sample answer

In order to hypothesise about the relationships between organisms in tracing human evolution, scientists study the similarities between living primates. The evidence from living primates continues to mount as new technologies are developed.

These technologies include:

- DNA/DNA hybridisation
- DNA sequencing

Karyotype is a display of condensed chromosomes arranged in pairs. They are prepared from dividing somatic cells arrested at metaphase. This is stained and then viewed through a microscope with a digital camera. Chromosomes entered onto a computer which rearranges them according to size and shape.

DNA/DNA hybridisation uses genetic engineering techniques which take DNA from organisms from different species and splice them together to make a hybrid. The more closely related the species, the more similar their DNA. The DNA hybrid is a measure of the evolutionary closeness of the 2 organisms eg this technique has shown that the difference between chimpanzees' DNA and humans' DNA is 0.7%, showing that humans are more closely related to chimpanzees than either species is to the gorilla.

DNA sequencing is a genetic engineering technique whereby DNA of different primate species can be sequenced and matched to examine similarities. This requires the use of PCR techniques which makes it possible to copy and amplify minute amounts of DNA.

The development of these technologies required a knowledge of:

- The structure of the DNA molecule.
- The identification of enzymes necessary to cut out the required gene from sample DNA (restriction enzymes).
- Knowledge of the process of DNA replication and its manipulation for PCR.
- The identification of enzymes necessary to rejoin the pieces of DNA (ligases).

Without the increase in our knowledge of DNA, these technologies would not have been developed and the relationships between primates would still be unsure.

Question 33 (continued)

(d) (i) (3 marks)

Outcomes Assessed: H10, H13**Targeted Performance Bands:** 3-6

Criteria	Marks
• Description of culture with more than 3 examples of major events.	3
• Description of culture and up to three examples.	2
• Identification of culture with one example.	1

Culture is described as the knowledge acquired by either direct teaching or imitation. The major events in the cultural evolution of humans include the use of primitive tools, the use of fire, the development of technological skills, the development of language and communication and the production of art. To do this, humans cooperated together in groups.

(ii) (2 marks)

Outcomes Assessed: H10, H14**Targeted Performance Bands:** 3-6

Criteria	Marks
• Describes 2 types of evidence for cultural evolution.	2
• Identifies 2 types of evidence for cultural evolution, OR	1
• Describes 1 type of evidence of cultural evolution.	

The cultures of prehistoric humans are known mainly through the excavation of stone tools and other preserved artefacts. The artistic explosion of cave art, which still survives, led humans to develop their communication skills.

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OPTION 5

Question 34 - BIOCHEMISTRY (25 marks)

(a) (i) (3 marks)

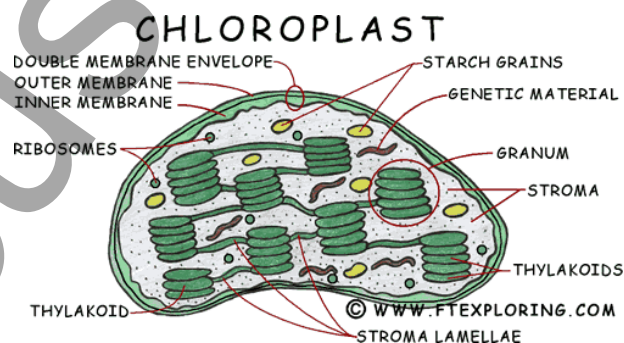
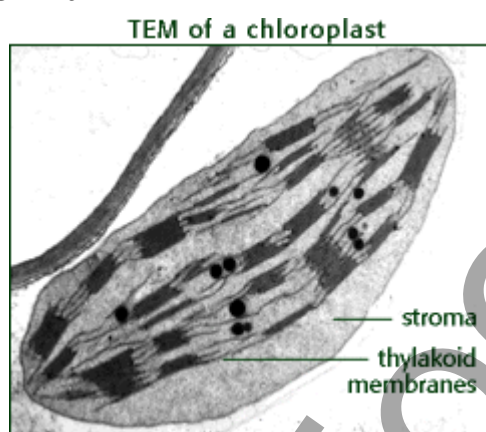
Outcomes Assessed: H6, H13

Targeted Performance Bands: 2-4

Criteria	Marks
Correct biological drawing of chloroplast with labels identifying thylakoids, stroma, and outer and inner membranes. Scale should be included.	3
- Biological drawing of chloroplast with at least 3 structures drawn and labelled correctly, OR - Biological drawing of chloroplast with at least 2 structures drawn and labelled correctly and an accurate scale.	2
Simple drawing, not to scale with limited labelled structures.	1

Sample answer

Size 2-7 μm



(a) (ii) (1 mark)

Outcomes Assessed: H6, H13

Targeted Performance Bands: 2-4

Criteria	Mark
Correct answer.	1

Sample answer

Thylakoid membrane.

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Question 34 (continued)

(a) (iii) (2 marks)

Outcomes Assessed: H1, H6**Targeted Performance Bands: 2-4**

Criteria	Marks
• Outline that Sachs proved that chlorophyll is located in special bodies (chloroplasts) within plant cells.	2
• Identify that Sachs showed that chlorophyll is located in special bodies (chloroplasts) within plant cells.	1

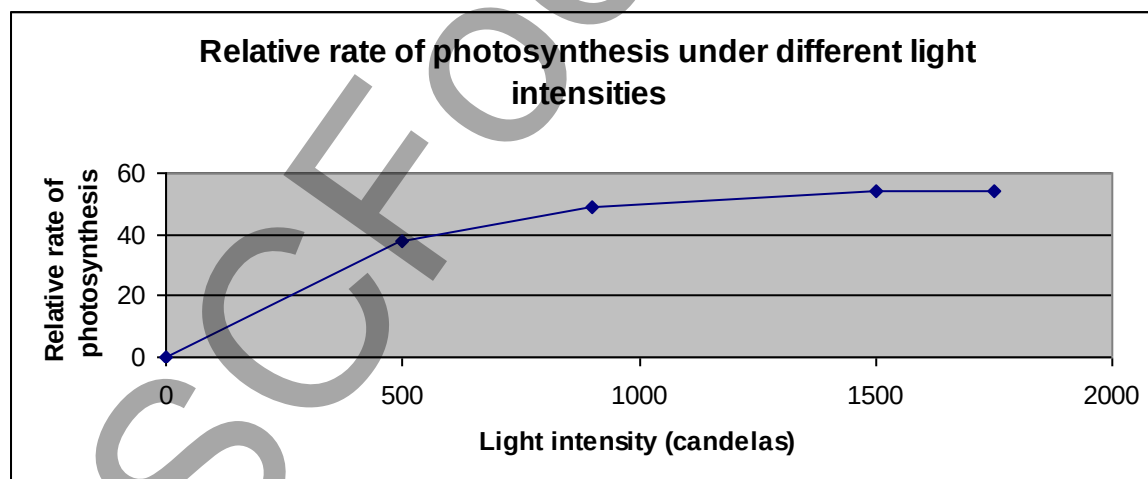
Sample answer

Sachs proposed that chlorophyll was involved in photosynthesis. Using iodine as an indicator for starch, he showed that that starch accumulates in leaves when exposed to light. He found that starch which is made up of glucose molecules, accumulates in chloroplasts.

(b) (i) (4 marks)

Outcomes Assessed: H12, H13**Targeted Performance Bands: 3-6**

Criteria	Marks
• Data graphed as a line graph, correctly labelled x and y axis with correct units, scale and points plotted accurately.	3-4
• 2-3 of the above points demonstrated.	1-2

Sample answer

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Question 34 (continued)

(b) (ii) (1 mark)

(Outcomes Assessed: H11, H13)**Targeted Performance Bands: 3-4**

Criteria	Mark
Correct prediction made.	1

Sample answer

54 candelas.

(b) (iii) (2 marks)

(Outcomes Assessed: H1, H6, H13)**Targeted Performance Bands: 2-5**

Criteria	Marks
Outline that Blackman and Mathgel hypothesised that photosynthesis as a two-step reaction and identify the steps as the light reaction and carbon fixation reaction.	2
Identify that Blackman and Mathgel hypothesised that photosynthesis as a two-step reaction.	1

Sample answer

Blackman and Mathgel hypothesized that photosynthesis is a two-step process, with 'light reactions' providing chemical energy and the hydrogen that is subsequently used to fix carbon. They called the carbon fixation reactions 'dark reactions'.

(c) (8 marks)

(Outcomes Assessed: H1, H3, H6, H13)**Targeted Performance Bands: 4-6**

Criteria	Marks
Defines and describes the process of photosynthesis, giving historical perspective of our understanding of the process. Explains one advance in technology and/or scientific understanding and evaluates its influence on our increased knowledge of photosynthesis.	7-8
Describes the process of photosynthesis, giving historical perspective of our understanding of the process. Outlines one advance in technology and/or scientific understanding and its influence on our increased knowledge of photosynthesis.	5-6
Defines the process of photosynthesis, giving historical perspective of our understanding of the process. Outlines one advance in technology and/or scientific understanding.	3-4
Identifies the process of photosynthesis and/or identifies one advance in technology and/or scientific understanding.	1-2

Question 34 (continued)**Sample answer**

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Photosynthesis has been said to be the most important biochemical process on Earth. Photosynthesis takes place only in the green parts of plants and the raw ingredients are sunlight, carbon dioxide and water. Energy in sunlight is converted to chemical energy in molecules in the form of sugars. Oxygen is produced as a byproduct. Our understanding of photosynthesis has a long history. It wasn't until 100 years after von Sachs proposed the general photosynthetic equation, that the mechanism of carbon fixation and the way in which light energy is actually used in photosynthesis was finally worked out.

One of the major advances in technology that allowed this to happen was the discovery and use of radioactivity in radioactive tracer experiments. Radioactive tracers or isotopes can be placed in a biological system and then followed by detecting the radiation. They can track the movement and speed of a substance or process as it passes through a biological system. The most important radioisotope in biology is carbon-14 (^{14}C) and this can be used to follow the movement of carbon in the plant body. With the discovery of ^{14}C the biochemical pathway used to fix CO_2 into glucose could be worked out (Calvin cycle or light –independent stage of photosynthesis). The understanding of photosynthesis took many centuries to develop. Increases in technology and scientific understanding, particularly in the area of physics, allowed greatly increased understanding of the process by allowing the path of carbon in the plant to be followed.

(d) (i) (1 mark)

Outcomes Assessed H6

Targeted Performance Bands: 3-6

Criteria	Mark
Correct answer.	1

Sample answer

ATP is the energy source of every living cell

(d) (ii) (3 marks)

Outcomes Assessed H6, H13

Targeted Performance Bands: 4-6

Criteria	Marks
Discusses both nature and organization of the phosphodiester bonds between the phosphate groups of the adenosine triphosphate molecule.	3
Identifies both nature and organization of the phosphodiester bonds between the phosphate groups of the adenosine triphosphate molecule.	2
Identifies in a simple manner the nature or the organization of the phosphodiester bonds between the phosphate groups of the adenosine triphosphate molecule.	1

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Question 34 (continued)

Sample answer

The ATP molecule is an adenine molecule bonded to a ribose (5-carbon) sugar, to which are attached 3 phosphate groups. Phosphodiester bonds are 2 ester type bonds that form between phosphorus and oxygen atoms of the adenine molecule. Once the first phosphate ester is formed, then it is possible for one or more inorganic phosphate groups to react forming a chain of 2 or more phosphate groups. The energy store in ATP is in the phosphodiester bonds.

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