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Centre Number

Student Number

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**2008**  
**TRIAL HIGHER SCHOOL CERTIFICATE**  
**EXAMINATION**

# Biology

## General Instructions

1. Reading time – 5 minutes
- Working time – 3 hours
  - Write using blue or black pen
  - Draw diagrams using pencil
  - Board-approved calculators may be used
  - Use the Data Sheet and Periodic Table provided
  - Use Multiple Choice Answer Sheet provided
  - Write your Centre Number and Student Number at the top of this page and page 2 and 7.

**Total marks – 100**

### Section I

Pages 3-18

**75 marks**

This section has two parts, Part A and Part B

Part A – 15 marks

- Attempt Questions 1-15
- Allow about 30 minutes for this part

Part B – 60 marks

- Attempt Questions 16-29
- Allow about 1 hour and 45 minutes for this part

### Section II

Pages 19-24

**25 marks**

- Attempt ONE question from Questions 30-34
- Allow about 45 minutes for this section

#### Disclaimer

Every effort has been made to prepare this Examination in accordance with the Board of Studies documents. No guarantee or warranty is made or implied that the Examination paper mirrors in every respect the actual HSC Examination question paper in this course. This paper does not constitute 'advice' nor can it be construed as an authoritative interpretation of Board of Studies intentions. No liability for any reliance use or purpose related to this paper is taken. Advice on HSC examination issues is only to be obtained from the NSW Board of Studies. The publisher does not accept any responsibility for accuracy of papers which have been modified.

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Centre Number

**YEAR 12 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION 2008**

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Student Number

**BIOLOGY – MULTIPLE CHOICE ANSWER SHEET**

Select the alternative A, B, C, or D that best answers the question.  
Fill in the response oval completely.

**Sample**     $2 + 4 =$  (A) 2            (B) 6            (C) 8            (D) 9

A             B             C             D

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A             B             C             D

If you have changed your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and drawing an arrow as follows:

A             B             C             D

*correct*

**ATTEMPT ALL QUESTIONS**

- |                 |           |                         |                         |                         |                         |
|-----------------|-----------|-------------------------|-------------------------|-------------------------|-------------------------|
| <b>Question</b> | <b>1</b>  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>2</b>  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>3</b>  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>4</b>  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>5</b>  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>6</b>  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>7</b>  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>8</b>  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>9</b>  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>10</b> | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>11</b> | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>12</b> | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>13</b> | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>14</b> | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
|                 | <b>15</b> | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |

**Section I**  
**75 marks**

**Part A – 15 marks**

**Attempt Questions 1-15**

**Allow about 30 minutes for this part**

Use the Multiple Choice Answer Sheet provided

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**1** Homeostasis is best described as

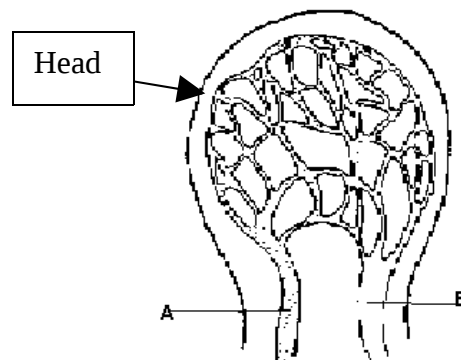
- (A) the maintenance of a relatively stable environment
- (B) control of substances in the blood
- (C) reabsorption of glucose by the kidney tubules
- (D) varying the rate of breathing according to activity

**2** Compared to arteries, veins

- (A) carry less blood
- (B) have thicker walls
- (C) carry blood containing the same proportion of red blood cells
- (D) carry blood under greater pressure

**3** If A is blood entering the head and B is blood leaving the head you would expect B to contain more

- (A) oxygen
- (B) carbon dioxide
- (C) urea
- (D) glucose



**4** Animals produce various nitrogenous wastes such as ammonia, urea or uric acid to dispose of excess amino acids. The difference in the type of nitrogenous waste produced is an adaptation to

- (A) different protein needs
- (B) availability of energy
- (C) availability of water
- (D) a terrestrial existence

**5** Desert plants carry on photosynthesis very slowly and consequently grow very slowly. The most likely reason for this is

- (A) the stomates are closed much of the time reducing gas exchange
- (B) their reduced surface area for transpiration (and photosynthesis)
- (C) the high availability of light in the desert
- (D) high temperatures in the desert

**6** RNA differs from DNA in that

- (A) RNA contains thymine instead of uracil
- (B) RNA is not found in the nucleus
- (C) RNA is usually double stranded rather than single stranded
- (D) RNA contains uracil instead of thymine

**7** What proportion of parent DNA is contained in each daughter cell after replication?

- (A) 100%
- (B) 75%
- (C) 50%
- (D) 25%

**8** Human cells that ingest bacteria are known as

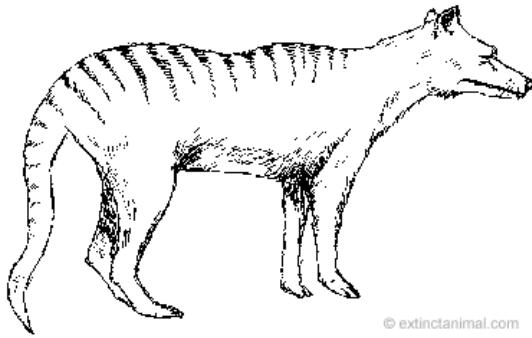
- (A) pathogens
- (B) phagocytes
- (C) antigens
- (D) antibodies

**9** The body's defence mechanisms can be classified as specific and non-specific. Which of the following would be classified as a specific mechanism?

- (A) The action of tears
- (B) The production of antibodies
- (C) The clotting of blood
- (D) The action of lymph nodes

- 10** What do inherited, nutritional and environmental diseases have in common?
- (A) They are mostly diseases of developed nations
  - (B) They are all non-infectious diseases
  - (C) They can all be prevented using vaccinations
  - (D) They are all preventable diseases
- 11** Successful vaccination results in
- (A) passive immunity
  - (B) immune deficiency
  - (C) the formation of antigens by cells
  - (D) the production of memory cells
- 12** A liver transplant patient is kept under sterile conditions for some time after the operation because a transplant patient is very susceptible to disease. The most likely reason for this is that
- (A) the immune system is suppressed by drugs
  - (B) the liver is not functioning properly
  - (C) incompatibility between the blood of the donor and the recipient immobilizes the recipient's immune system for a short period
  - (D) antibodies formed to combat any infection would also attack the donated organ
- 13** A number of crosses between two plant parents produced a phenotypic ratio of 1:1 in the offspring. This indicates that
- (A) the genotype of both parents was heterozygous
  - (B) the genotype of one parent was heterozygous
  - (C) the genotype of both parents was homozygous
  - (D) the result was due to co-dominance in both parents
- 14** The term punctuated equilibrium is used to describe
- (A) Darwin's theory of evolution by natural selection
  - (B) a stable ecosystem disturbed by introduced plants or animals
  - (C) evolution with short periods of rapid change interrupted by long periods with little change
  - (D) evolution by gradual change as shown in the fossil record of the horse

15 There are many examples of animals that, despite not being closely related to each other, show some similarities, eg: Thylacine and wolf. This convergence in unrelated organisms is most likely the result of



- (A) similar biochemistry
- (B) mutation
- (C) the environment acting as a selecting agent
- (D) genetic variation

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Centre Number

**Biology**  
**Section I (continued)**

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Student Number

**Part B – 60 marks**  
**Attempt Questions 16-29**  
**Allow about 1 hour and 45 minutes for this part**

Answer the questions in the spaces provided.

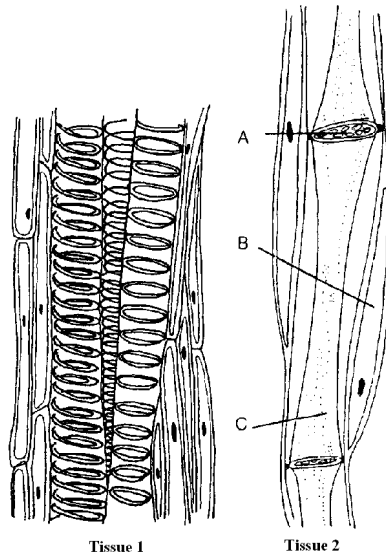
Show all relevant working in questions involving calculations.

**Marks**

**Question 16 (4 marks)**

(a) Identify tissue 1 and 2 shown in the longitudinal sections below.

**1**



Tissue 1.....

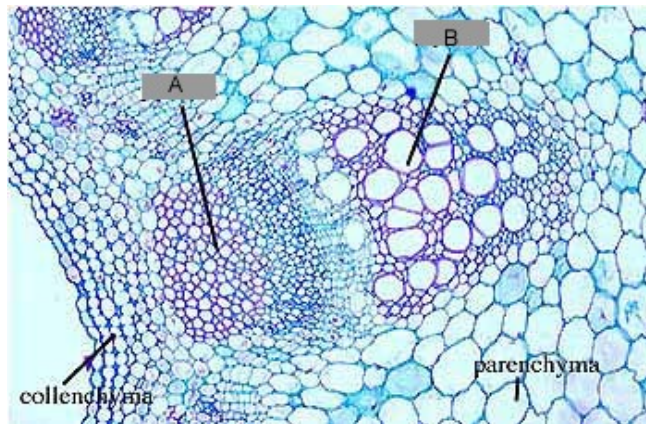
Tissue 2.....

**Question 16 continues over page**

**Question 16** (continued)

**Marks**

- (b) Identify the tissue labelled B shown in the cross-section of a vascular bundle and the substance which is transported by this tissue. **1**



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- (c) Describe a current theory about a process responsible for the movement of the substance in tissue B. **2**

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**Question 17 (4 marks)**

**Marks**

Bromelain (an enzyme found in fresh pineapple) breaks down gelatin protein. Gelatin proteins, when dissolved in hot water and allowed to cool, form a semi-solid jelly. Hence the name gelatin. The manufacturers of gelatin containing desserts warn the consumer against adding fresh pineapple to jelly desserts to prevent the breakdown of gelatine protein resulting in the jelly not setting.

**4**

Using the above information, design an investigation to test the effect of increased temperature on the activity of bromelain.  
Ensure your method allows for the collection of valid and reliable data.

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**Question 18 (3 marks)**

Identify a current technology that allows hospitals to measure the levels of oxygen in the blood and using an example, explain why this technology would be used.

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**Question 19** (2 marks)

**Marks**

Using the letter that corresponds to each statement, place the following events that occur during DNA replication in the correct order. **2**

- (a) bonds between complementary bases break
- (b) bonds between complementary bases form
- (c) DNA molecule uncoils from one end
- (d) Complementary strands of DNA separate
- (e) daughter DNA molecules coil into double helixes
- (f) sugar-phosphate bonds form

**Question 20** (7 marks)

The data shown in the table below was obtained during an investigation into the functions of the human kidney. **7**

Explain how the processes of filtration and reabsorption in the mammalian nephron can account for the changes in concentration of the sodium ions, glucose and urea as shown in the above table.

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**Question 21** (5 marks)

**Marks**

(a) 'A whale's flipper is homologous to a human hand'. Explain the evolution of these structures.

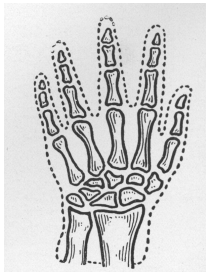
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(b) Describe, using an example, how the theory of evolution is supported by evidence from a different area of study.

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**Question 22** (2 marks)

**Marks**

Using the descriptions provided below, complete the following table.

*Monohybrid cross, sex-linkage, chromosomal theory of inheritance, one gene –one protein hypothesis*

<b>Scientist(s)</b>	<b>Contribution</b>
Sutton and Boveri	
Morgan	
Beadle and Tatum	
Mendel	

2

**Question 23** (3 marks)

The following table presents the results of an experiment to demonstrate the effects of radiation on the germination of seedlings.

<b>Dose of radiation applied (Roentgens units)</b>	<b>Description of plants after 7 days</b>
0	100% of seedlings germinated, normal germination and growth
15	50% of seedlings germinated, stunted growth
30	25% seedlings germinated, stunted growth

(a) In the experiment, radiation was used as a mutagenic agent. Define the term mutation.

1

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(b) What is the term given to the group of plants that did not receive any radiation in this experiment.

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**Question 23 continued over page**

**Question 23** (continued)

**Marks**

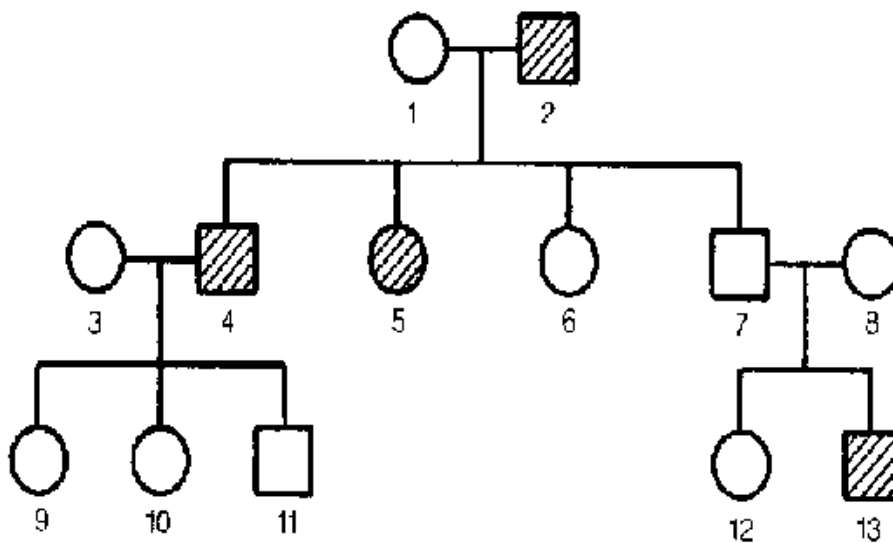
(c) State a conclusion that can be drawn from the results described above.

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**Question 24** (6 marks)

The pedigree shown is for a family in which some members suffer from familial emphysema, an inherited lung disease. The shaded individuals are those that suffer from the condition.



(a) Explain whether the trait shown above is dominant or recessive.

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**Question 24 continued over page**

**Question 24 (continued)**

**Marks**  
**2**

(b) Using appropriate symbols identify the genotypes of individuals 1 and 4.

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(c) If individual 13 marries a woman who does not suffer from familial emphysema, but whose father was a sufferer, what percentage of their children might suffer from familial emphysema? Show your working.

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**2**

**Question 25 (5 marks)**

The weaver ants of tropical Australia construct their homes from leaves and silk. Scientists have identified the silk producing genes in weaver ants and by placing these genes into bacteria or plants, it should be possible to create large amounts of insect silk, which is light, but tough enough to make a bullet-proof vest.

(a) State the name given to a species that has had genes of a different organism added to their genetic makeup? **1**

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(b) Discuss the ethical issues associated with the use of species that have had genes of a different organism added to their genetic makeup. Specific examples must be given. **4**

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**Question 26 (7 marks)**

**Marks**

- (a) Define the term 'pathogen'. **1**  
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- (b) Name the type of pathogen that causes the disease, malaria. **1**  
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- (c) Identify distinguishing features of this type of pathogen. **2**  
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- (d) Draw a simple time line showing the historical development of our understanding of the cause and prevention of malaria. Include at least 4 significant developments. **3**

**Question 27 (3 marks)**

Thrush is a common disease caused by a yeast, *Candida albicans*, which lives harmlessly on the skin, in the mouth, gut or vagina. This disease occurs due to an imbalance of microflora. **3**

Describe how this disease could develop.

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**Question 28** (5 marks)

**Marks**

Throughout history there have been many developments in Biology. Discuss, using appropriate examples, why some biological investigations have been best undertaken individually while others are best undertaken by a team.

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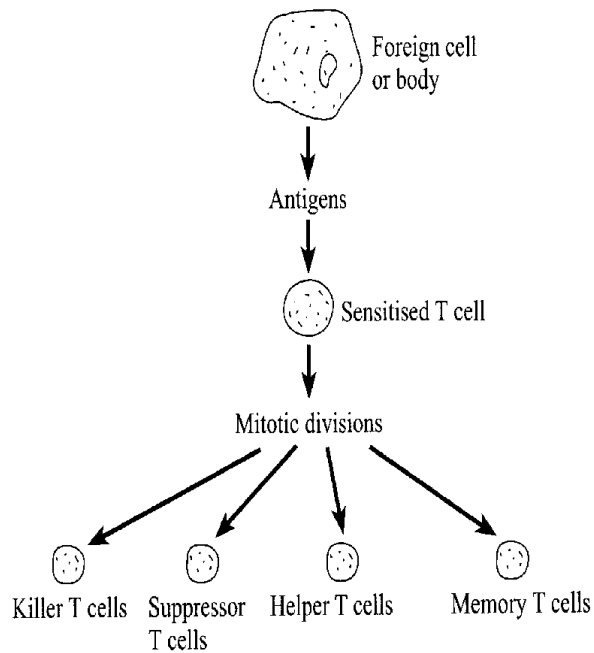
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**Question 29** (4 marks)

**Marks**

The following diagram show one component of the immune response.



2

- (a) Describe the role of the following cells in terms of the immune response.
- (i) Suppressor T cells
  - (ii) Killer T cells

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**Question 29 continues over page**

**Question 29 (continued)**

**Marks**

(b) Describe the interaction between B and T lymphocytes.

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## End of Section I – Part B

**QATs**

Quality Assessment Tasks

2008 TRIAL HIGHER SCHOOL CERTIFICATE  
EXAMINATION

## Biology

### Section II

**25 marks**

**Attempt ONE question from Questions 30-34**

**Allow about 45 minutes for this section**

Answer the question in a SEPARATE writing booklet.

Show all relevant working in questions involving calculations.

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		Page
Question 30	Communication	20
Question 31	Biotechnology	21
Question 32	Genetics: The Code Broken?	22
Question 33	The Human Story	23
Question 34	Biochemistry	24

**Question 30 – Communication** (25 marks)**Marks**

- (a) (i) Identify the role of receptors. **1**
- (ii) Draw a flow chart to show the steps involved in the production of a response to a stimulus. **2**
- (b) Copy and complete the following table relating structures of the eye to their function. **4**

<b>Structure</b>	<b>Function</b>
Conjunctiva	
Choroid	
Lens	
Optic nerve	

- (c) (i) Identify the relationship between nerves, neuronal fibres and nerve cells.
- (ii) Using a simple drawing, identify those areas of the cerebrum involved in the perception of light and sound.
- (d) The data presented in the table below shows the refractive indices of fluids/structures associated with the eye.

<b>Fluid/structure</b>	<b>Refractive index (N)</b>
Air	1.00
Water	1.33
Cornea	1.38
Aqueous humour	1.34
Lens	1.42

- (i) Present the data in a graph. **4**
- (ii) Define refraction. **1**
- (iii) Explain the change to the path of a ray of light as it passes from air into the cornea. **2**
- (e) Assess the impact of our increased knowledge and understanding about the anatomy and function of the human ear. **8**

### End of Question 30

#### Question 31 – Biotechnology (25 marks) Marks

- (a) (i) Outline an ancient Australian Aboriginal use of biotechnology. 1
- (ii) Justify the use of the term ‘biotechnology’ when discussing agricultural practices used 10,000 years ago. 3
- (b) During the study of this option you conducted a first-hand investigation to demonstrate the use of fermentation processes in bread **or** alcohol production. 2
- (i) Using a named type of micro-organism:  
Outline the role of a named micro-organism in the fermentation process.
- (ii) Describe how changes in technology and scientific knowledge have modified the traditional uses of biotechnology. 4
- (c) The data presented in the table below shows the rate of respiration in presence of different concentrations of sugar.

Sugar concentration (%w/v)	Fermentation rate (mL) (CO <sub>2</sub> /min)
0	0
1	0.01
2.5	0.10
3	0.12
3.5	0.13

- (i) Present the data in a graph. 4
- (ii) Predict the fermentation rate at a sugar concentration of 4%. 1
- (d) Describe the role of biotechnology in the production of monoclonal antibodies. 2
- (e) ‘Modern biotechnology includes recombinant DNA technology.’ 8

Assess the impact of our increased knowledge of the structure and functions of DNA on the development of recombinant DNA techniques.

### End of Question 31

**Question 32 – Genetics: The Code Broken? (25 marks)****Marks**

- (a) Identify 2 examples of characteristics determined by multiple alleles in an organism other than a human. **1**
- (b) Blood type analysis is often used in resolving paternity issues. A woman who is blood type O has a child with blood group A. There is a dispute over who is the father. One male has type B, and the other type AB blood.
- (i) Which of the 2 men could be the father of the child? **1**
- (ii) Explain if it is possible to eliminate one of the men completely based on blood type analysis. **1**
- (iii) Explain how DNA fingerprinting could be used to resolve the paternity of the child. **2**
- (c) The data presented in the table below shows the effect of X-ray exposure on the rate of sex-linked mutations.

<b>X-ray exposure (Roentgen units)</b>	<b>Sex-linked mutations (%)</b>
1000	3.5
2500	8
4000	11.8
6000	15.5

- (i) Present the data in a graph on the graph paper provided. **4**
- (ii) Predict the percentage of sex-linked mutations for a dose of 7000 Roentgen. **1**
- (iii) Outline the ability of DNA to repair itself. **3**
- (d) Describe the evidence which indicates the presence of ancestral vertebrate gene homologues in lower animal classes. **4**
- (e) ‘Gene therapy is possible once the genes responsible for harmful conditions are indentified.’ **8**

Assess the impact of our increased knowledge of DNA on the development and use of gene therapy to manage a genetic disease, a named form of cancer or AIDS.

**End of Question 32**

**Question 33 – The Human Story (25 marks)****Marks**

- (a) (i) Explain what is meant by the term species. **2**
- (ii) Outline features that classify humans as: **2**
- mammals and
  - primates
- (iii) Discuss the use of the terms hominin and hominid. **2**

(b) The table below shows the evolution of hominid cranial capacity:

<b>Species</b>	<b>Cranial capacity (cm<sup>3</sup>)</b>
Australopithecus afarensis	490
Paranthropus robustus	550
Homo habilis	800
Homo erectus	1200
Homo sapien	1500

- (i) Present the data in a graph. **4**
- (ii) Outline the relationship between the change in cranial capacity and culture of the hominid. **1**
- (iii) Discuss difficulties in interpreting the past from the fossil record alone. **2**
- (c) ‘Fossil and other biological evidence assist in the clarification of the relationships between humans and other primates.’ **7**

Assess the impact of our increased knowledge of DNA on the development of technologies which could be used to determine relationships between groups of primates.

- (d) (i) Describe the major events in the cultural evolution of humans. **3**
- (ii) Describe examples of existing physical evidence that infer cultural evolution. **2**

**End of Question 33**



**Question 34 – Biochemistry (25 marks)****Marks**

- (a) (i) Draw and label the structure of a chloroplast as seen using an electron microscope. **3**
- (ii) In which part of a chloroplast would chlorophyll be found? **1**
- (iii) Explain Sachs' contribution to our understanding of photosynthesis. **2**

- (b) The table below shows the relative rate of photosynthesis under different light intensities.

<b>Light intensity (candelas)</b>	<b>Relative rate of photosynthesis</b>
0	0
500	38
900	49
1500	54
1750	54

- (i) Present the data in a graph. **4**
- (ii) Predict the relative rate of photosynthesis under a light intensity of 2,000 candelas. **1**
- (iii) Outline Blackman and Mathgel's hypothesis. **2**
- (c) Evaluate how a major advance in our scientific understanding or in technology has changed our knowledge of the process of photosynthesis. **8**
- (d) (i) Identify the role of ATP in a living cell. **1**
- (ii) Discuss the nature and organisation of the phosphodiester bonds between the phosphate groups of the adenosine triphosphate molecule. **3**

**End of Paper**

## 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	
<b>Exam Section</b>	<b>Question</b>	<b>Marks</b>	<b>Syllabus/Course outcomes</b>	<b>Content</b>	<b>Targeted performance band</b>	<b>Answer</b>
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)**

<b>Question</b>	<b>Correct Response</b>	<b>Outcomes Assessed</b>	<b>Targeted Performance Bands</b>
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
<ul style="list-style-type: none"><li>• Correctly identifies tissue 1 and tissue 2.</li></ul>	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
<ul style="list-style-type: none"><li>• Correctly identifies Tissue B and the substance transported by this tissue.</li></ul>	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
<ul style="list-style-type: none"><li>• Correctly describes theory.</li></ul>	2
<ul style="list-style-type: none"><li>• Correctly identifies theory.</li></ul>	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
<ul style="list-style-type: none"><li>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.</li></ul>	4
<ul style="list-style-type: none"><li>Includes 3 or 4 of the above points.</li></ul>	2-3
<ul style="list-style-type: none"><li>Includes 2 of the above points.</li></ul>	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
<ul style="list-style-type: none"><li>Identify a current technology that measure levels of oxygen in the blood.</li><li>Using a specific example explains why the technology is used.</li></ul>	3
<ul style="list-style-type: none"><li>Identify a current technology that measure levels of oxygen in the blood and identifies why the technology is used, OR</li><li>Using a specific example explains why the technology is used.</li></ul>	2
<ul style="list-style-type: none"><li>One of the above points.</li></ul>	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
<ul style="list-style-type: none"><li>All 6 in correct sequence.</li></ul>	2
<ul style="list-style-type: none"><li>Any 3 in correct sequence.</li></ul>	1

**Sample answer**

CADFBC

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

Criteria	Marks
<ul style="list-style-type: none"> <li>Identifies the role of filtration.</li> <li>Explains why glucose is not found in urine.</li> <li>Explains why urea and sodium ions are found in greater concentrations in urine compared with glomerular filtrate.</li> <li>Explains why urea and sodium ions are not reabsorbed.</li> </ul>	6-7
<ul style="list-style-type: none"> <li>Identifies the role of filtration.</li> <li>Explains why glucose is not found in urine.</li> <li>Identifies that urea and sodium ions are found in greater concentrations in urine compared with glomerular filtrate.</li> <li>Identifies that urea and sodium ions are not reabsorbed.</li> </ul>	4-5
<ul style="list-style-type: none"> <li>Identifies the role of filtration.</li> <li>Identifies why glucose is not found in urine.</li> <li>Identifies that urea and sodium ions are found in greater concentrations in urine compared with glomerular filtrate.</li> <li>Identifies that urea and sodium ions are not reabsorbed.</li> </ul>	2-3
<ul style="list-style-type: none"> <li>2 of the above points.</li> </ul>	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
<ul style="list-style-type: none"> <li>Relate structure to common ancestor.</li> </ul>	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
<ul style="list-style-type: none"> <li>Defines the theory of evolution; uses an example of a line of evidence and describes how this supports the theory of evolution.</li> </ul>	3-4
<ul style="list-style-type: none"> <li>Name a line of evidence and describe how this supports the theory of evolution, OR</li> <li>Uses an example and describe how this supports the theory of evolution.</li> </ul>	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
<ul style="list-style-type: none"> <li>Correctly links all four scientists to contributions.</li> </ul>	2
<ul style="list-style-type: none"> <li>Correctly links two or three scientists to contributions.</li> </ul>	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
<ul style="list-style-type: none"> <li>Correctly defines mutation.</li> </ul>	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
<ul style="list-style-type: none"><li>Correctly identifies the control.</li></ul>	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
<ul style="list-style-type: none"><li>Correctly states a conclusion.</li></ul>	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
<ul style="list-style-type: none"><li>Correctly explains the inheritance pattern shown.</li></ul>	2
<ul style="list-style-type: none"><li>Correctly identifies the inheritance pattern shown.</li></ul>	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
<ul style="list-style-type: none"><li>Identifies the genotypes of both individuals.</li></ul>	2
<ul style="list-style-type: none"><li>Identifies the genotype of one individuals.</li></ul>	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
<ul style="list-style-type: none"><li>Provides 2 ethical arguments for and 2 against the use of transgenic species.</li><li>Provides examples.</li></ul>	3-4
<ul style="list-style-type: none"><li>Provides 1 ethical argument for and 1 against the use of transgenic species with examples, OR</li><li>Provides 2 arguments for and 2 against the use of transgenic species without examples.</li></ul>	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
<ul style="list-style-type: none"><li>Correctly defines pathogen.</li></ul>	1

**Sample answer**

A pathogen is a disease causing organism.

(b) (1 mark)

**Outcomes Assessed:** H13

**Targeted Performance Band:** 2-3

Criteria	Mark
<ul style="list-style-type: none"><li>Protozoan.</li></ul>	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.

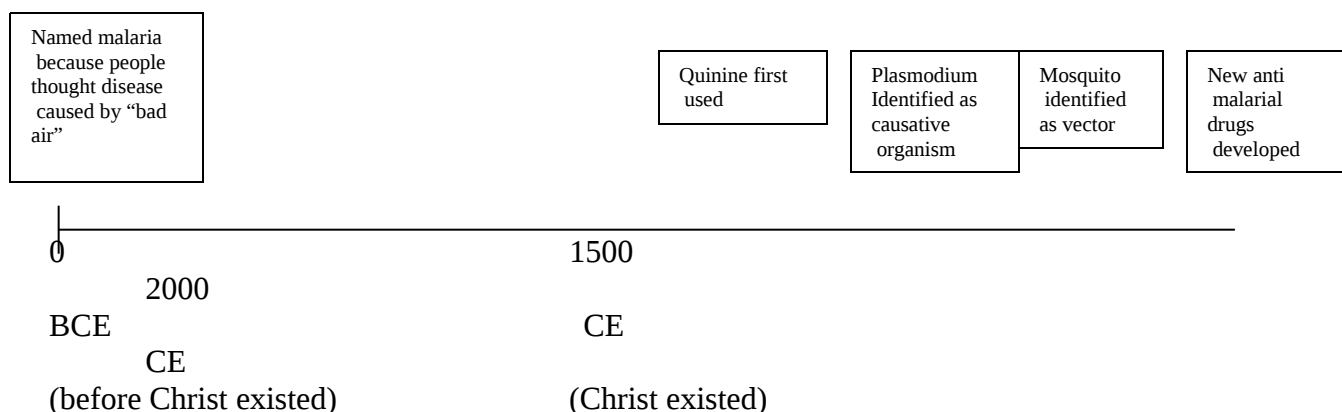
(d) (3 marks)

**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

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bacteria is reduced. This causes an upset in the balance of microflora, allowing the yeast to proliferate, resulting in thrush.

**Question 28** (5 marks)

**Outcomes Assessed:** H13, H15

**Targeted Performance Bands:** 4-6

Criteria	Marks
<ul style="list-style-type: none"> <li>• Provide examples of an investigation undertaken by a team and by an individual.</li> <li>• Using the above examples, gives advantages and disadvantages of both team and individual research.</li> </ul>	5
<ul style="list-style-type: none"> <li>• Provide examples of an investigation undertaken by a team and by an individual.</li> <li>• Gives general advantages and disadvantages of both team and individual research unrelated to example given.</li> </ul>	3-4
<ul style="list-style-type: none"> <li>• Gives general advantage and one disadvantage of both team and individual research, OR</li> <li>• Provide examples of an investigation undertaken by a team and by an individual.</li> </ul>	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 macrophags 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
<ul style="list-style-type: none"><li>Identifies correct relationship between nerves, neuronal fibres and nerve cells.</li></ul>	1

**Sample answer**

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

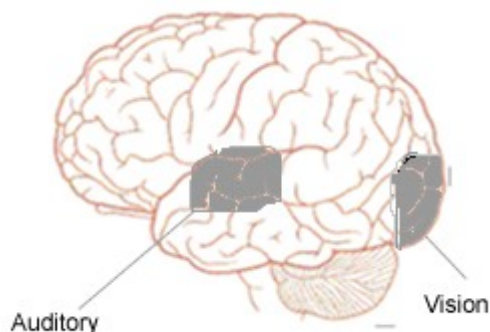
(c) (ii) (2 marks)

**Outcomes Assessed: H6**

**Targeted Performance Bands: 2-4**

Criteria	Marks
<ul style="list-style-type: none"><li>Correctly identifies location of areas involved in perception of light and sound using a drawing.</li></ul>	2
<ul style="list-style-type: none"><li>Correctly identifies location of areas involved in perception of light or sound using a drawing.</li></ul>	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
<ul style="list-style-type: none"><li>Identifies correct relationship between nerves, neuronal fibres and nerve cells.</li></ul>	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**

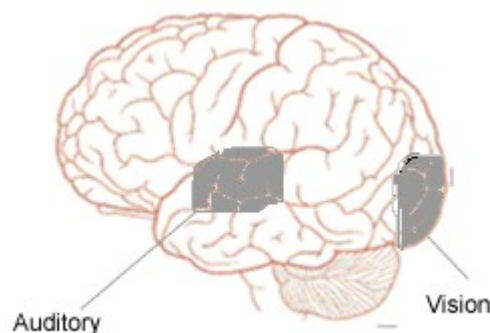
Criteria	Marks
<ul style="list-style-type: none"><li>Correctly identifies location of areas involved in perception of light and sound using a drawing.</li></ul>	2
<ul style="list-style-type: none"><li>Correctly identifies location of areas involved in perception of light or sound using a drawing.</li></ul>	1

**Sample answer**

Back  
occipital lobe

Front

Temporal lobe



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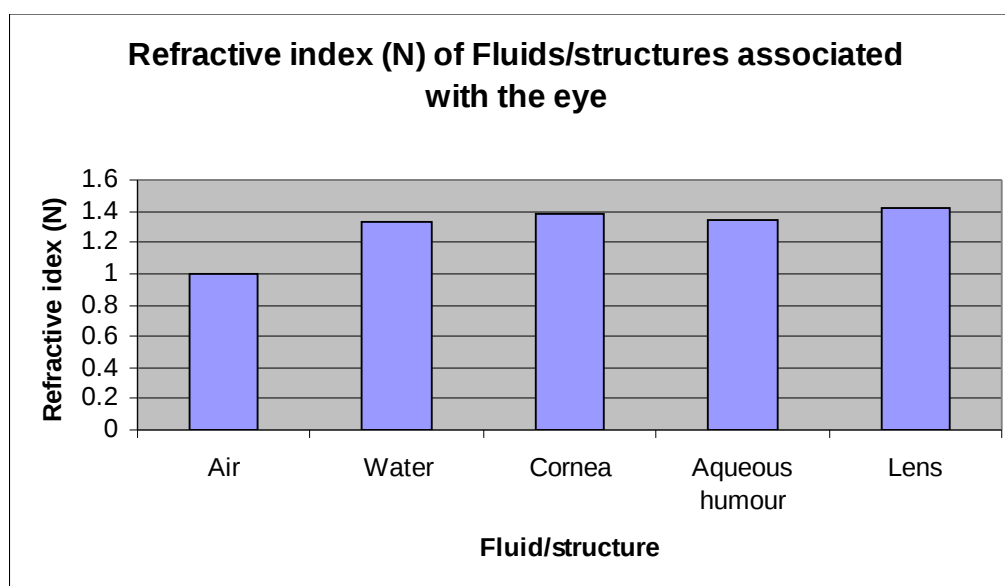
**Question 30** (continued)

(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

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cornea is denser than air.

**Question 30** (continued)

(e) (8 marks)

**Outcomes Assessed: H1, H6**

**Targeted Performance Bands: 3-6**

Criteria	Marks
<ul style="list-style-type: none"><li>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.</li></ul>	7-8
<ul style="list-style-type: none"><li>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</li><li>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.</li></ul>	5-6
<ul style="list-style-type: none"><li>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.</li></ul>	3-4
<ul style="list-style-type: none"><li>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.</li></ul>	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
<ul style="list-style-type: none"> <li>Correctly describes how 2 changes in technology and scientific knowledge have modified the traditional uses of biotechnology.</li> </ul>	3-4
<ul style="list-style-type: none"> <li>Outlines how 1-2 changes in technology and scientific knowledge have modified the traditional uses of biotechnology.</li> </ul>	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)

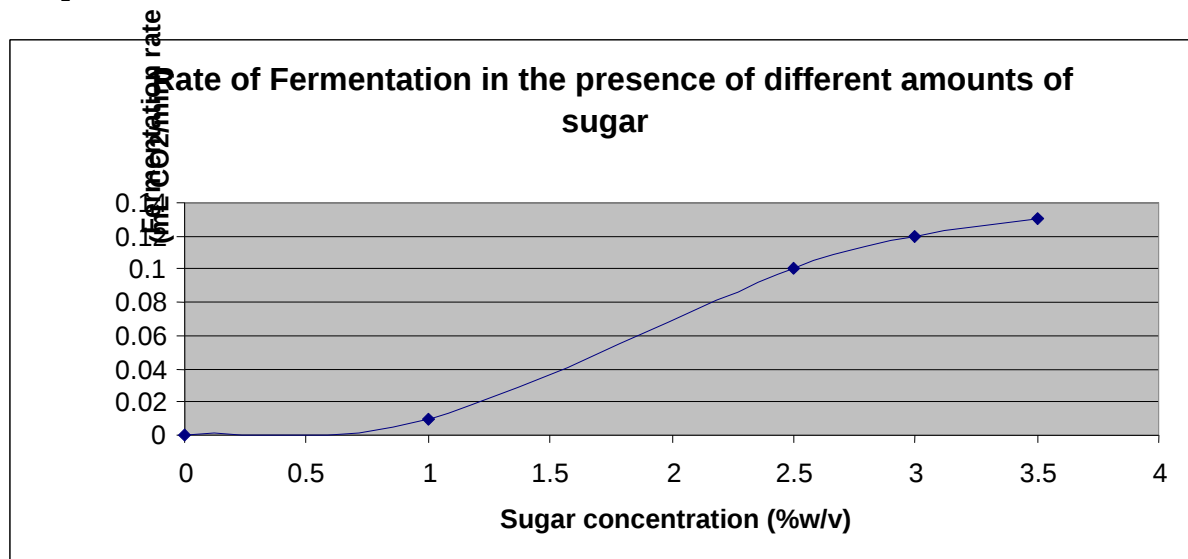
**Outcomes Assessed:** H12, H13**Targeted Performance Bands:** 3-6

Criteria	Marks
<ul style="list-style-type: none"> <li>Data graphed as a line graph, correctly labelled x and y axis with correct units, scale and points plotted accurately.</li> </ul>	3-4
<ul style="list-style-type: none"> <li>2-3 of the above points demonstrated.</li> </ul>	1-2

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Sample answer



Question 31 (continued)

(c) (ii) (1 mark)

(Outcomes Assessed: H6, H12, H13)

Targeted Performance Bands: 3-4

Criteria	Mark
<ul style="list-style-type: none"> <li>Correct prediction made.</li> </ul>	1

Sample answer

0.14mL Co<sup>2</sup>/min

(d) (2 marks)

(Outcomes Assessed: H3, H9, H13)

Targeted Performance Bands: 3-5

Criteria	Marks
<ul style="list-style-type: none"> <li>Correctly describes the role of biotechnology in the production of monoclonal antibodies.</li> </ul>	2
<ul style="list-style-type: none"> <li>Correctly outlines the role of biotechnology in the production of monoclonal antibodies.</li> </ul>	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
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<ul style="list-style-type: none"> <li>• 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.</li> </ul>	7-8
<ul style="list-style-type: none"> <li>• 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.</li> </ul>	5-6
<ul style="list-style-type: none"> <li>• 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.</li> </ul>	3-4
<ul style="list-style-type: none"> <li>• Defines biotechnology or simply outlines the process of recombinant DNA technology, AND/OR</li> <li>• Identifies the knowledge required for the development of this technology, using examples.</li> </ul>	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.



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

(a) (1 mark)

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

Criteria	Mark
<ul style="list-style-type: none"><li>Correctly identifies 2 examples of characteristics determined by multiple alleles in an organism other than a human.</li></ul>	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
<ul style="list-style-type: none"><li>Correctly identifies which male could be the father.</li></ul>	1

**Sample answer**

Male with type B blood.

(b) (ii) (1 mark)

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

Criteria	Mark
<ul style="list-style-type: none"><li>Correctly explains if it is possible to eliminate either of the men based on blood type analysis.</li></ul>	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.

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**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.

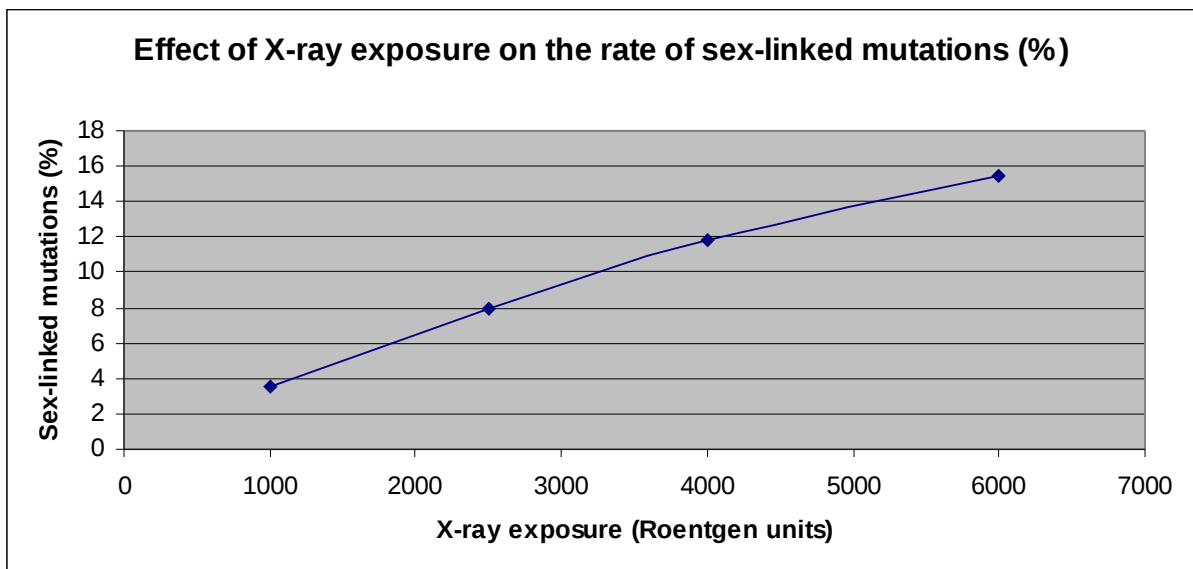
(c) (i) (4 marks)

**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
<ul style="list-style-type: none"> <li>Correct prediction made.</li> </ul>	1

**Sample answer**

17%

(c) (iii) (3 marks)

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

Criteria	Marks
<ul style="list-style-type: none"> <li>Correctly outlines the ability of DNA to repair itself.</li> </ul>	2-3
<ul style="list-style-type: none"> <li>Correctly identifies the ability of DNA to repair itself.</li> </ul>	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
<ul style="list-style-type: none"> <li>Correctly defines gene homologues and their functions and provides evidence of their presence in lower animal classes.</li> </ul>	3-4
<ul style="list-style-type: none"> <li>Correctly defines gene homologues and their functions, OR provides evidence of their presence in lower animal classes.</li> </ul>	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
<ul style="list-style-type: none"><li>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.</li></ul>	7-8
<ul style="list-style-type: none"><li>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.</li></ul>	5-6
<ul style="list-style-type: none"><li>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.</li></ul>	3-4
<ul style="list-style-type: none"><li>Defines gene therapy or simply outlines the process of recombinant DNA technology, AND/OR</li><li>Identifies the knowledge required for the development of this technology, using examples.</li></ul>	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
<ul style="list-style-type: none"><li>• Correct explanation of the term species including both reproductive capabilities and a common gene pool.</li></ul>	2
<ul style="list-style-type: none"><li>• Correct explanation of the term species including either reproductive capabilities OR a common gene pool.</li></ul>	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
<ul style="list-style-type: none"><li>• Outline 2 correct features of a mammal that classify humans as mammalian and 2 correct primate features that classify humans as primates.</li></ul>	2
<ul style="list-style-type: none"><li>• Outline 2 correct features of a mammal that classify humans as mammalian or 2 correct primate features that classify humans as primates, OR</li><li>• Outline 1 correct feature of a mammal that classify humans as mammalian and 1 correct primate feature that classify humans as primates.</li></ul>	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: *fangernails 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.

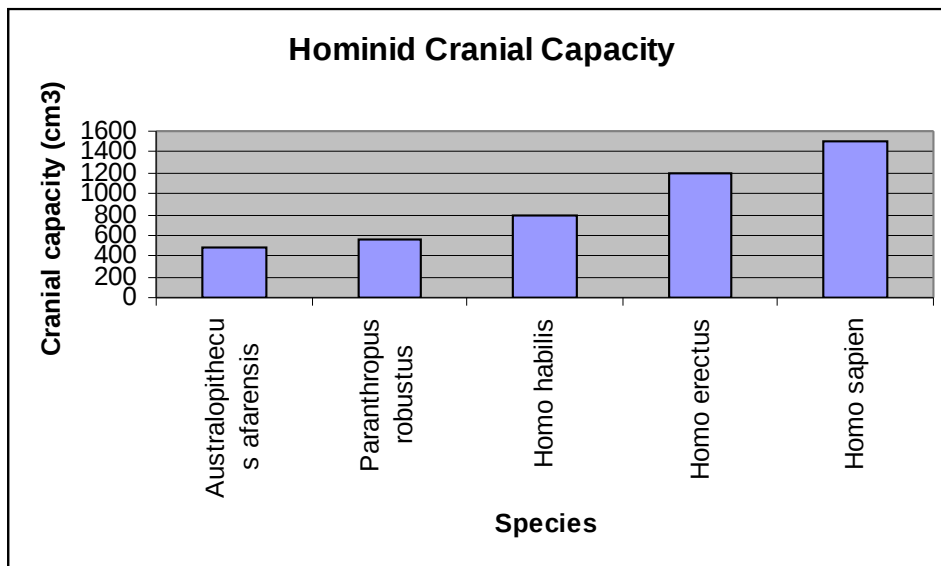
(b) (i) (4 marks)

**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
<ul style="list-style-type: none"> <li>Correct relationship outlined.</li> </ul>	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
<ul style="list-style-type: none"> <li>2 difficulties in interpretation discussed.</li> </ul>	2
<ul style="list-style-type: none"> <li>2 difficulties in interpretation identified, OR</li> <li>1 difficulty in interpretation discussed.</li> </ul>	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
<ul style="list-style-type: none"> <li>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.</li> </ul>	6-7
<ul style="list-style-type: none"> <li>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.</li> </ul>	4-5
<ul style="list-style-type: none"> <li>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.</li> </ul>	2-3
<ul style="list-style-type: none"> <li>Identifies at least 1 technology used to study relationships between organisms, using an example, OR</li> <li>Identifies 1 piece of knowledge required for the development of this technology.</li> </ul>	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 are 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)

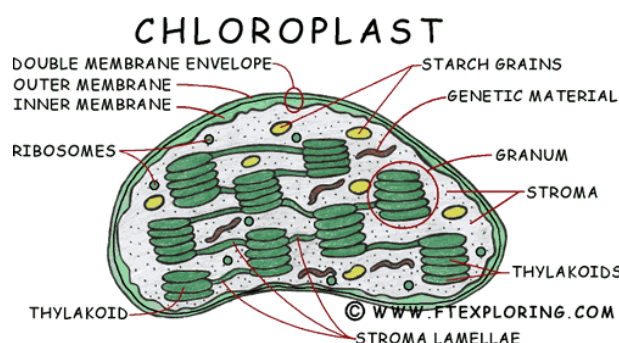
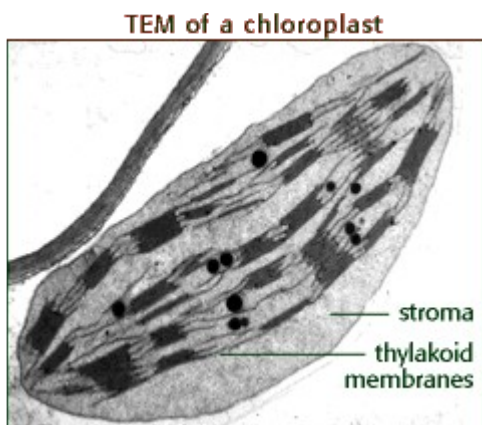
**Outcomes Assessed: H6, H13**

**Targeted Performance Bands: 2-4**

Criteria	Marks
<ul style="list-style-type: none"> <li>Correct biological drawing of chloroplast with labels identifying thylakoids, stroma, and outer and inner membranes. Scale should be included.</li> </ul>	3
<ul style="list-style-type: none"> <li>Biological drawing of chloroplast with at least 3 structures drawn and labelled correctly, OR</li> <li>Biological drawing of chloroplast with at least 2 structures drawn and labelled correctly and an accurate scale.</li> </ul>	2
<ul style="list-style-type: none"> <li>Simple drawing, not to scale with limited labelled structures.</li> </ul>	1

**Sample answer**

Size 2-7  $\mu\text{m}$



(a) (ii) (1 mark)

**Outcomes Assessed: H6, H13**

**Targeted Performance Bands: 2-4**

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

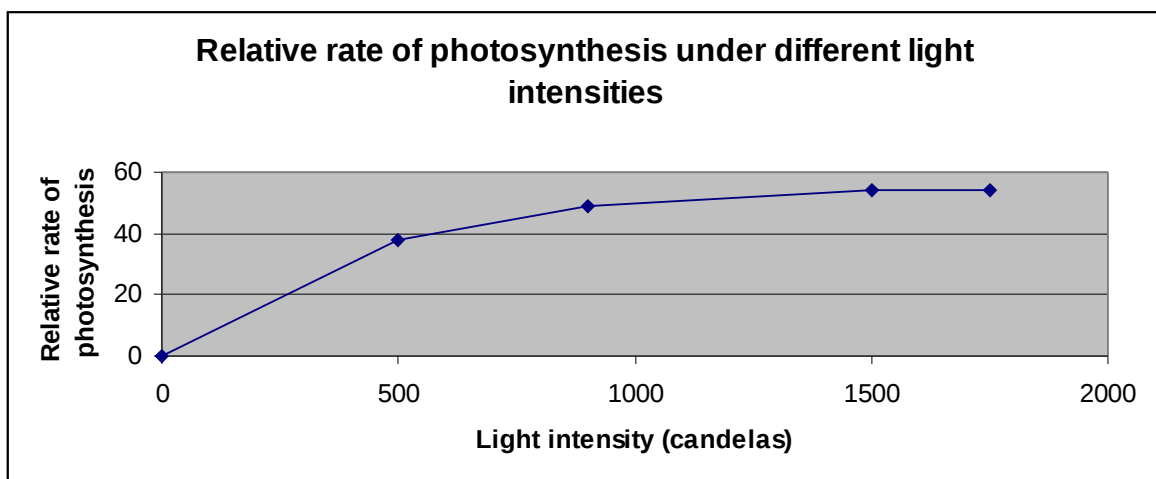
(b) (i) (4 marks)

**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
<ul style="list-style-type: none"> <li>Correct prediction made.</li> </ul>	1

**Sample answer**

54 candelas.

(b) (iii) (2 marks)

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

Criteria	Marks
<ul style="list-style-type: none"> <li>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.</li> </ul>	2
<ul style="list-style-type: none"> <li>Identify that Blackman and Mathgel hypothesised that photosynthesis as a two-step reaction.</li> </ul>	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
<ul style="list-style-type: none"> <li>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.</li> </ul>	7-8
<ul style="list-style-type: none"> <li>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.</li> </ul>	5-6
<ul style="list-style-type: none"> <li>Defines the process of photosynthesis, giving historical perspective of our understanding of the process. Outlines one advance in technology and/or scientific understanding.</li> </ul>	3-4
<ul style="list-style-type: none"> <li>Identifies the process of photosynthesis and/or identifies one advance in technology and/or scientific understanding.</li> </ul>	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 ( $^{14}\text{C}$ ) and this can be used to follow the movement of carbon in the plant body. With the discovery of  $^{14}\text{C}$  the biochemical pathway used to fix  $\text{CO}_2$  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
<ul style="list-style-type: none"> <li>Correct answer.</li> </ul>	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
<ul style="list-style-type: none"> <li>Discusses both nature and organization of the phosphodiester bonds between the phosphate groups of the adenosine triphosphate molecule.</li> </ul>	3
<ul style="list-style-type: none"> <li>Identifies both nature and organization of the phosphodiester bonds between the phosphate groups of the adenosine triphosphate molecule.</li> </ul>	2
<ul style="list-style-type: none"> <li>Identifies in a simple manner the nature or the organization of the phosphodiester bonds between the phosphate groups of the adenosine triphosphate molecule.</li> </ul>	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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