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Centre Number

Student Number

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**2007**  
**TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION**

# Biology

## General Instructions

- 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 Multiple Choice Answer Sheet provided
- Write your Centre Number and Student Number at the top of this page and the Multiple Choice Answer Sheet provided.

**Total marks – 100**

### Section I

Pages 3-20

**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 16-30
- Allow about 1 hour and 45 minutes for this part

### Section II

Pages 21-29

**25 marks**

- Attempt ONE question from Questions 31-35
- 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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## Section I

75 marks

### Part A – 15 marks

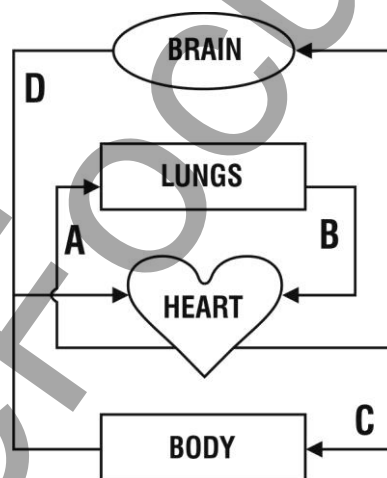
#### Attempt Questions 1-15

Allow about 30 minutes for this part

Use the Multiple Choice Answer Sheet provided

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- 1 Most reptiles will lie in the sun during the early, cooler part of the day and then will move into more shaded areas later in the day when it is warmer. When they behave this way their body temperature
- (A) is protected from variations in the ambient temperature
  - (B) will change at a more regular and constant rate
  - (C) changes according to changes in the ambient temperature
  - (D) is kept constant regardless of changes in the ambient temperature
- 2 The diagram below represents part of the circulation of blood through the major parts of the mammalian body.



If blood samples were taken at points A, B, C and D, which sample would contain the greatest concentration of hydrogen carbonate (bicarbonate) ions?

- (A) A
- (B) B
- (C) C
- (D) D

- 3** Several theories have been used to describe the processes responsible for the movement of materials through plants.

Which of the following statements about the translocation of sucrose (sugar) in phloem is correct?

- (A) Sucrose molecules are actively transported from one sieve tube cell to the next.
- (B) Sucrose molecules move by osmosis in solution dissolved in water.
- (C) Sucrose molecules are actively loaded into the phloem at the sink.
- (D) Sucrose molecules are moved by pressure flow within the sieve tubes.

- 4** Feedback mechanisms are used to

- (A) provide information about stimuli in the environment
- (B) maintain a relatively stable internal environment
- (C) maintain metabolic and physiological functions
- (D) counteract changes from the stable state

- 5** Which of the following statements about the structure and function of blood vessels is correct?

- (A) All arteries carry oxygenated blood away from the heart.
- (B) Blood in veins is under higher pressure than blood in arteries.
- (C) Veins have valves to prevent the back flow of blood.
- (D) Capillary walls allow for the exchange of all molecules.

- 6** A plant breeder was planning a first-hand investigation to gather data about the effect of changing soil pH on the petal colour of a particular plant species. In this experiment it would be best to use

- (A) a group of randomly chosen plants of the same species and repeat the experiment at different soil pH levels
- (B) several groups of randomly chosen plants of that species and repeat the experiment at different soil pH levels
- (C) one plant of that species which is tested repeatedly in the experiment at different soil pH levels
- (D) several groups of randomly chosen plants of different species and repeat the experiment at different soil pH levels

- 7 The percentage of the nitrogenous bases adenine, thymine, cytosine, and guanine taken from a range of organisms is shown in the table.

DNA source	Adenine(A) %	Cytosine(C) %	Guanine(G) %	Thymine(T) %
Mammal	24.0	26.0	25.9	24.1
Bacteria	24.0	26.0	26.0	24.0
Fungi	27.3	22.7	22.6	27.4
Eucalypt	36.0	13.9	14.0	36.1

Analysis of this data shows that

- (A) plants have more adenine than the other organisms
  - (B) DNA is able to be transcribed to form complementary RNA
  - (C) complementary nitrogenous bases pair A with T and C with G
  - (D) the amounts of A and T are always close to or equal to 50%
- 8 Which of the statements about the new reproductive technologies is correct?
- (A) New hybrids produced by cloning give rise to increased variation and increased protein yield.
  - (B) Genetically different strains of a species can be crossed to form a transgenic organism.
  - (C) Artificial pollination reduces variation as it results in all offspring having an identical phenotype.
  - (D) Transgenic organisms contain a gene from another organism and can express the protein it codes for.
- 9 Mary, a curly haired woman and John, a straight haired man have three children all of whom have wavy hair. Mary's sister June and her husband Ned both have wavy hair.

Which of the following represents the offspring that June and Ned can expect to have?

- (A) 100% wavy haired
- (B) 50% curly: 50% wavy
- (C) 25% curly: 50% wavy: 25% straight
- (D) 25% curly: 50% straight: 25% wavy

- 10** In garden peas, pods can be green or yellow. In order to determine which of these traits is dominant, a plant breeder performed a series of crosses between different plants, K, L, M, and N. The crosses and the F1 outcomes are given in the table.

Cross performed	F1 outcome
Green (K) x Green (L)	100% green
Green (K) x yellow(M)	100% green
Green (L) x Green (N)	76 green : 23 yellow
Green (L) x yellow(M)	99 green : 101 yellow

Which of the following represents an explanation Mendel would have used to explain these outcomes?

- (A) Yellow pods was the dominant trait and green pods was recessive.
- (B) The factor for green pods was dominant over the factor for yellow pods.
- (C) The green and yellow genes were co-dominant and both were expressed.
- (D) The allele for green pods was dominant over the allele for yellow pods.

- 11** A student examined samples of two different types of pathogens and described them as follows. 'I examined sample A with a magnifying glass and clearly saw six legs and two small antennae. Sample B was examined using a light microscope and contained individual cells that had clear nuclei. These cells lacked both chloroplasts and a cell wall.'

The types of pathogens in samples A and B respectively are

- (A) macroparasite and bacteria
- (B) fungi and bacteria
- (C) macroparasite and protozoan
- (D) fungi and protozoan

- 12** Down syndrome, or trisomy 21, is a disease caused by the non-disjunction of the 21<sup>st</sup> chromosome during meiosis. Down syndrome is an example of

- (A) a nutritional deficiency
- (B) an environmental disease
- (C) an infectious disease
- (D) an inherited disease

**13** An organism is described as a pathogen when it

- (A) is parasitic and causes disease
- (B) is parasitic or causes disease
- (C) is parasitic
- (D) causes disease

**14** An antigen is a molecule that

- (A) is produced by B-cells
- (B) triggers an immune response
- (C) kills bacteria
- (D) is produced by T-cells

**15** Which of the following would be regarded as the subject of an epidemiological study?

- (A) Relating the incidence of a disease to its cause in a population.
- (B) Treating an infectious disease with a particular antibiotic.
- (C) Identifying a specific pathogen in a sample of tissue.
- (D) Developing a safe and effective vaccine against a specific pathogen.

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Centre Number

## Biology

### Section I (continued)

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Student Number

**Part B – 60 marks****Attempt Questions 16-30****Allow about 1 hour and 45 minutes for this part**

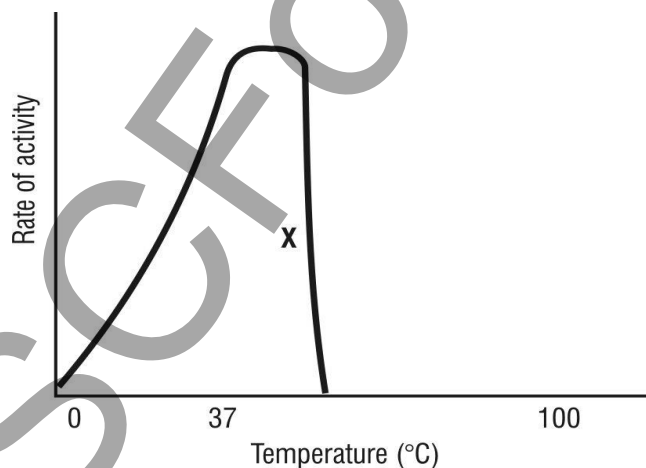
Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

**Question 16 (3 marks)****Marks**

Many procaryotes live in some of Earth's most extreme environments. Those that live in hot springs and deep-sea vents are called thermophiles.

- (a) On the axes is a graph that represents the effect of temperature on the activity of an enzyme found in a mammal. On the same axes, sketch the graph that would best represent the effect of temperature on the activity of an enzyme in a thermophile.

**1**

- (b) Explain why the level of activity is low at position X on the mammalian enzyme graph.

**2**

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**Question 17** (4 marks)**Marks**

Explain the relationship between the conservation of water and the production and excretion of concentrated nitrogenous wastes in an insect and a terrestrial mammal by completing the table.

**4**

	Insect	Mammal
Concentrated nitrogenous waste	.....	.....
Conservation of water	..... ..... .....	..... ..... .....

**Question 18** (4 marks)

Spinifex, a native grass often called porcupine grass, grows well in dry areas of Australia. The leaves of this plant are able to roll up in hot, dry and windy conditions. Furthermore, the stomates of this plant are enclosed in stomatal grooves, or pits, and therefore lie beneath the leaf surface.

**4**

Discuss how the stomatal grooves, or pits, and rolled leaves assist in the conservation of water.

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### Question 19 (7 marks)

## Marks

During your Biology course you performed a first hand investigation to estimate the size of red blood cells. 7

- Describe the method you used to gather the information that enabled you to estimate the size of these cells
- Discuss one safety precaution that you took
- Explain the measures you undertook to ensure that your results were reliable
- Draw a fully labelled, scaled diagram of a red blood cell (space on next page).

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**Question 19 continues on page 11**

Question 19 (continued)

**Question 20** ( 2 marks)

As our knowledge and understanding about the composition and functions of blood have improved, technologies have been developed that have assisted us in monitoring the level of substances in the blood. You have identified a current technology that is used to monitor oxygen saturation in the blood.

Describe and explain one condition under which this technology is used.

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**Question 21** (6 marks)

*Staphylococcus aureus* (staph) are microbes that are found on the skin and in the nose of people. They are usually harmless, but can sometimes cause serious illness. Some strains of staph have become resistant to the antibiotic methicillin (MRSA) and to other antibiotics that were used effectively in the past to treat infections.

- (a) Identify the role of antibiotics in the management of infectious disease. 1

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- (b) Explain how multi-drug resistant strains of *Staphylococcus aureus* have developed. 3

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- (c) Discuss two problems related to antibiotic resistance. 2

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**Question 22** (2 marks)

2

Describe the replication of DNA.

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**Question 23** (4 marks)

- (a) Draw a diagram to show crossing over between two genes, A and B, during gamete formation in an individual heterozygous for these genes. Label the diagram to indicate the processes that are occurring.

2

- (b) Explain how segregation of chromosomes contributes to increased variability in offspring of sexually reproducing organisms.

2

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**Question 24** (4 marks)

**Marks**

Modern biochemical techniques have provided very specific evidence to support the theory of evolution.

- (a) Explain one line of biochemical evidence that has provided support for the theory of evolution. **2**

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- (b) Using a named example, explain how advances in technology have changed scientific thinking about evolutionary relationships. **2**

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**Question 25** (3 marks)

**Marks**

In the 1920's dentists when X-raying teeth, used to stand above the patient and hold the X-ray film in the patient's mouth with their thumbs exposed. Today, the dentist and his assistant leave the room after placing the X-ray film in a holding frame and placing a lead shield over the patient's body. Explain why such precautions are now taken.

**2**

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**Question 26** (4 marks)

Haemophilia is caused by the inheritance of a recessive allele which is located on the X chromosome.

- (a) The first child born to a normal man and a normal woman was a normal son. The family was surprised that the second child was a haemophiliac son. Only the grandfather, the mother's father, is affected. All other grandparents are normal. Construct a pedigree or family tree to show the inheritance of haemophilia in this family.

**3**

**Question 26 continues on page 16**

Question 26 (continued)

Marks

- (b) Discuss a current use of pedigrees, other than displaying hereditary information in an easy to see graphic form.

1

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Question 27 (2 marks)

Food poisoning is a disease that can lead to serious health problems particularly in children. If food is not safely stored or properly handled it can cause illness if ingested. Explain how one practice in food preparation can assist in the control of disease.

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**Question 28** (4 marks)

**Marks**

During your study of Biology you were required to research one infectious disease. Using the information you gathered, processed and analysed, tabulate the cause, transmission and treatment of ONE named infectious disease in the space below.

**4**

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**Question 29** (4 marks)

## Marks

The Asian honey bee carries a parasite called the Varroa mite. The parasite attacks bee larvae and adult bees, ultimately destroying the entire honey bee colony. Most honey bee industries throughout the world, including New Zealand, are infected by the parasite. Australia, and its 65 million dollar honey bee industry, remains parasite free.

4

Using this or another named example, evaluate the effectiveness of quarantine measures in preventing the spread of plant and/or animal diseases into Australia or across regions of Australia.

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**Question 30** (8 marks)

**Marks**

Malaria is a disease that kills about 2.7 million people annually throughout the world. The malarial parasite is well adapted to living inside the human body. Once inside the body, certain proteins appear on the parasite's surface, triggering the immune response. However, these proteins not only vary between individual parasites, but each parasite can also vary the particular protein it displays.

**8**

Assess the implications of this adaptation for the malarial parasite, the implications for the immune response in humans and the implications for the production of an effective vaccine to help in the fight against malaria.

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**Question 30 continues on page 20**

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**End of Section I – Part B**

## Biology

### Section II

**25 marks**

**Attempt ONE question from Questions 31-35**

**Allow about 45 minutes for this section**

Answer the question in a SEPARATE writing booklet.

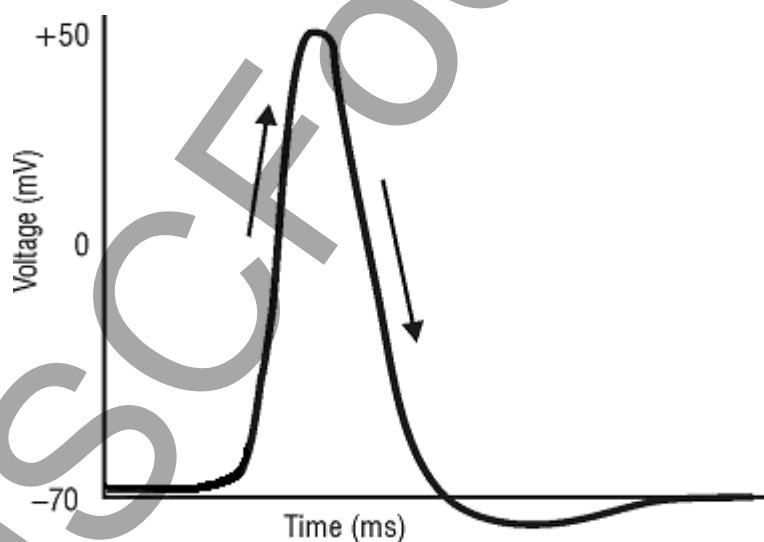
Show all relevant working in questions involving calculations.

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	Page
Question 31      Communication .....	22
Question 32      Biotechnology .....	23-24
Question 33      Genetics: The Code Broken? .....	25-26
Question 34      The Human Story .....	27-28
Question 35      Biochemistry .....	29

**Question 31 – Communication** (25 marks)**Marks**

- (a) (i) Outline the function of the iris and lens in the human eye. **2**
- (ii) Identify and distinguish between the function of the two different types of photoreceptor cells found in the retina. **4**
- (b) During your study of *Communication*, you modeled the process of accommodation.
- (i) Describe how you modeled the process of accommodation. **3**
- (ii) Identify ONE strength and ONE limitation of your model. **2**
- (iii) Explain how your model helped in your understanding of the process of accommodation. **2**
- (c) Technologies have been developed that can be used to assist hearing in humans. Describe the conditions under which these technologies will assist hearing. Discuss the limitations of each technology and assess the implications of these technologies for society. **7**
- (d) The graph below represents a typical action potential.



- (i) Identify the cells in which a typical action potential might occur. **1**
- (ii) Explain why not all stimuli generate such an action potential. **2**
- (iii) Describe what happens during the generation of an action potential. **2**

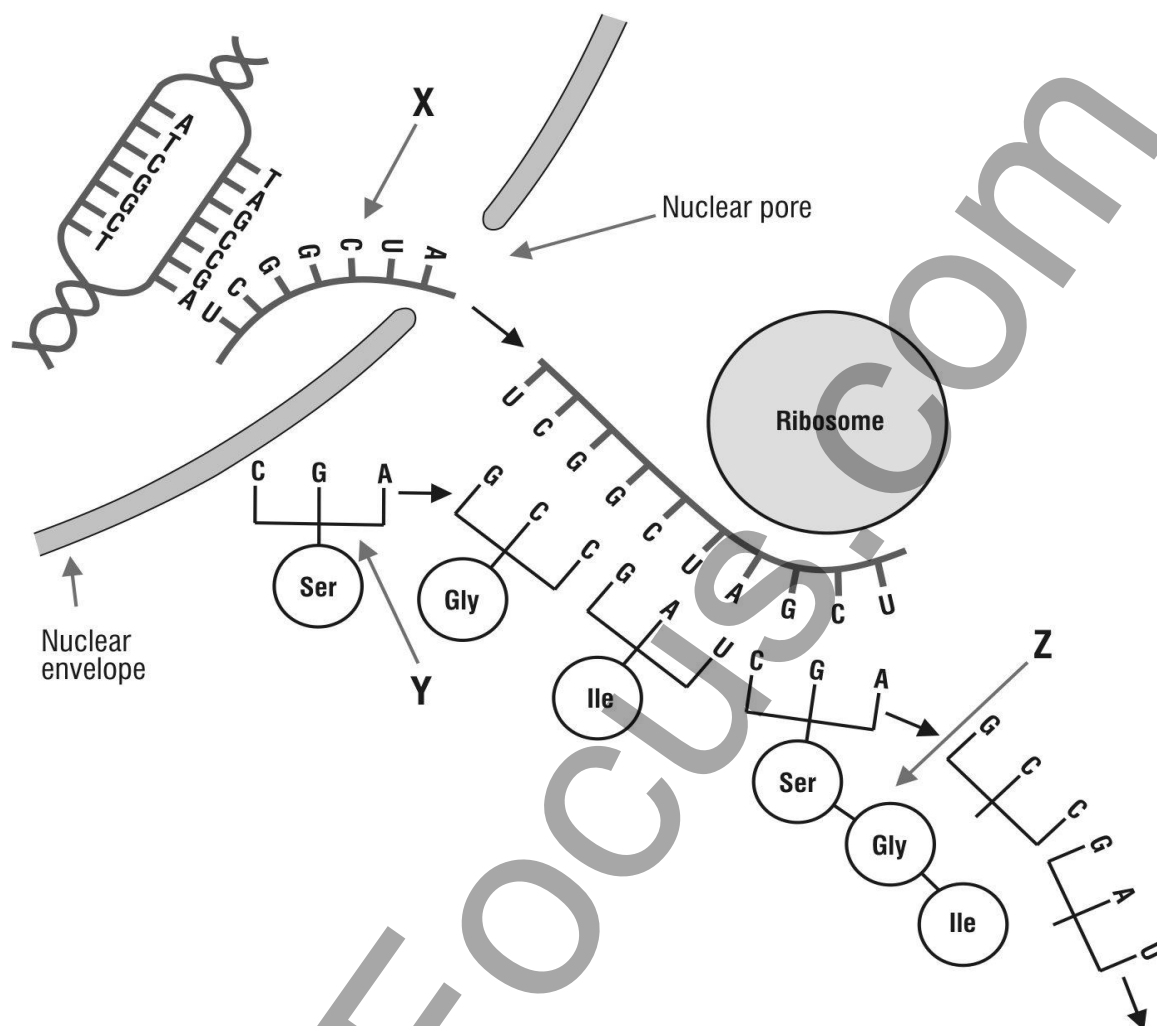
**End of Question 31**

**Question 32 – Biotechnology (25 marks)****Marks**

- (a) (i) Describe ONE change in a group of animals and ONE change in a group of plants that is the result of artificial selection of characteristics suitable for agricultural crops or livestock. **2**
- (ii) Describe a strain isolation method developed in the 1940's. **1**
- (iii) Using specific examples, outline TWO benefits of strain isolation methods that were used in biotechnology in the twentieth century. **3**
- (b) During your study of *Biotechnology*, you processed information to produce a flowchart on the sequence of events that result in the formation of recombinant DNA.
- (i) Describe how you processed and analysed information to produce the flowchart. **3**
- (ii) Identify ONE strength and ONE limitation of organising information in the form of a flowchart. **2**
- (iii) Explain how the process of constructing a flowchart enhanced your understanding of the sequence of events that result in the formation of recombinant DNA. **2**
- (c) Assess the impacts of named applications of biotechnology on society and/or the environment. **7**

**Question 32 continues on page 24**

- (d) The diagram represents the steps in the synthesis of a protein.



- (i) Identify the structures labeled X and Y and outline their function. 2
- (ii) Identify the structure labeled Z. Describe its formation and its role in cell metabolism. 3

End of Question 32



<b>Question 33 – Genetics: The Code Broken? (25 marks)</b>			<b>Marks</b>
(a)	(i)	Define the term polygenic inheritance and identify ONE example of polygenic inheritance in humans or another organism.	<b>2</b>
	(ii)	Distinguish between mutations of chromosomes and mutations of genes and give ONE example of each type.	<b>4</b>
(b)	During your study of <i>Genetics: The Code Broken</i> , you constructed a model of DNA.		
	(i)	Describe how you constructed the model, identifying the relevant components of the model and which parts of the DNA molecule they represent.	<b>3</b>
	(ii)	Identify ONE strength and ONE limitation of the model you constructed.	<b>2</b>
	(iii)	Explain how your model helped in your understanding of the nature of DNA.	<b>2</b>
(c)	The Human Genome project has enabled the identification of genes responsible for certain harmful conditions. Using advances in technology, gene therapy is now currently being used to manage certain diseases.		<b>7</b>

Analyse and assess the implications of these applications of technology for society by describing a current use of gene therapy used to manage an identified disease.

**Question 33 continues on page 26**

- (d) In tomato plants, the allele for purple stems (G) is dominant to the allele for green stems (g), and the allele for red fruit (R) is dominant to the allele for yellow fruit (r). Two tomato plants were crossed and 77 tomato seeds were collected. These seeds were then planted to reveal the phenotypes of the F<sub>1</sub> generation as shown in the table below.

F <sub>1</sub> Phenotype	No. of tomato plants
purple stems, red fruit	58
green stems, yellow fruit	19

- (i) One parent tomato plant in the above cross was heterozygous for the two traits. Identify the genotype of the other parent. 1
- (ii) Using the results in the table above, determine whether the genes for stem colour and fruit colour are linked or unlinked. Justify your answer. 3

The experiment was then repeated several times to gain a much larger sample size. In the subsequent series of crosses involving the same parents, the following results were obtained.

F <sub>1</sub> Phenotype	No. of tomato plants
purple stems, red fruit	526
purple stems, yellow fruit	10
green stems, red fruit	13
green stems, yellow fruit	180

- (iii) Suggest ONE reason for the appearance of the purple stemmed, yellow fruit plants and green stemmed, red fruit plants in the offspring. 1

**End of Question 33**

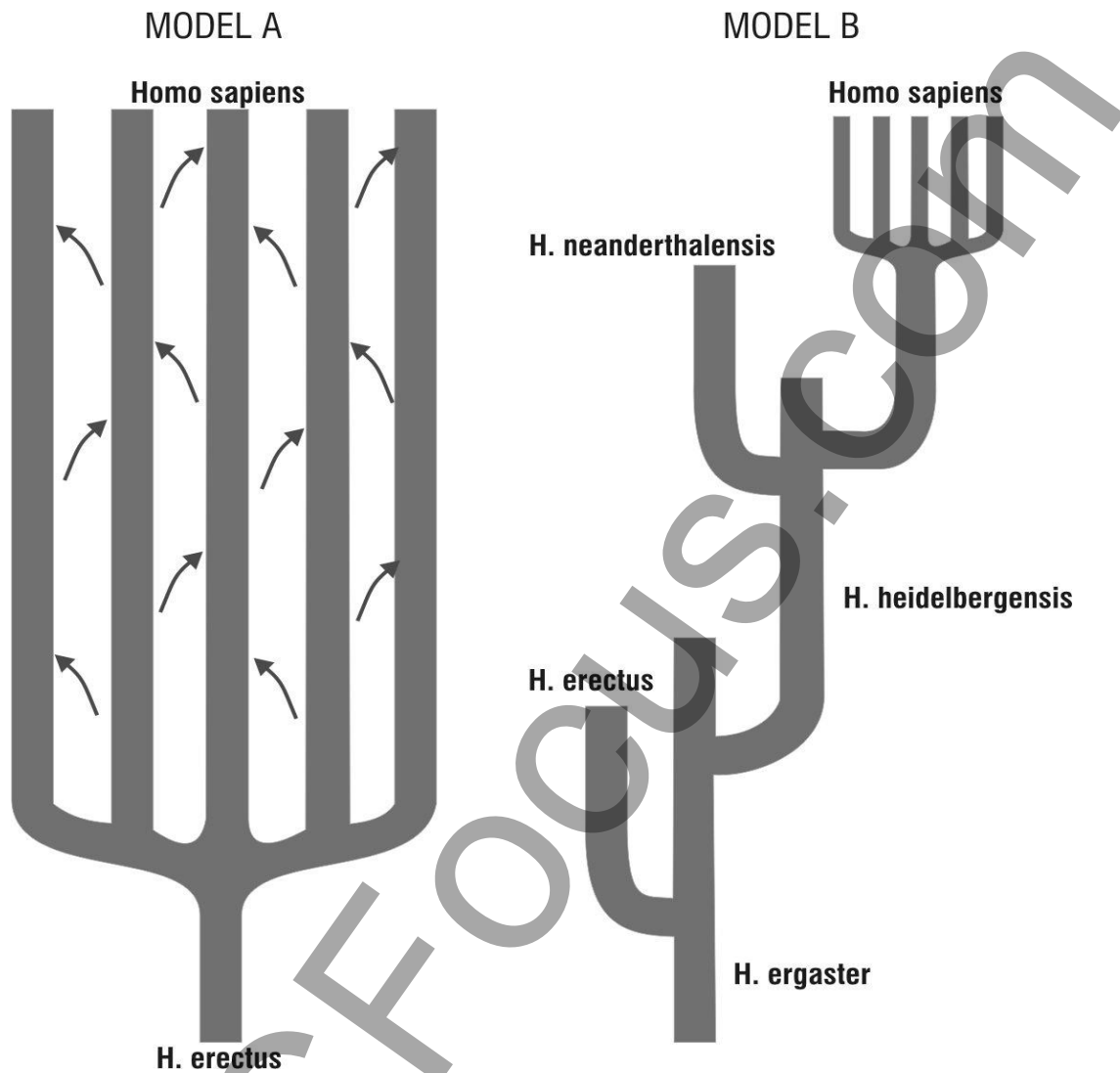
**Question 34 – The Human Story (25 marks)**

**Marks**

- (a) (i) Outline TWO features that classify humans as primates. **2**
- (ii) Distinguish between polymorphism and clinal gradation using ONE appropriate example for each from the wide range of human phenotypes. **4**
- (b) During your study of the *Human Story*, you modeled DNA-DNA hybridisation.
- (i) Describe how you modeled DNA-DNA hybridisation. **3**
- (ii) Identify ONE strength and ONE limitation of your model. **2**
- (iii) Explain how your model helped you to understand the process of DNA-DNA hybridisation and its use in determining relationships between groups of primates. **2**
- (c) Modern technologies may have an impact on future human populations. Using named examples of modern technologies, describe potential effects that these could have on human evolution. Analyse and assess the implications of these technologies on future human populations. **7**

**Question 34 continues on page 28**

- (d) The diagrams below represent two different models of human migration and evolution.



- (i) Identify which model, A or B, is the 'Out of Africa' model. 1
- (ii) Describe and evaluate evidence for the two different models of evolution. 4

End of Question 34

**Question 35 – Biochemistry (25 marks)****Marks**

- |  |       |  |   |
|--|-------|--|---|
| (a)  | (i)   | Identify TWO products of photosynthesis.   | 2 |
|  | (ii)  | Distinguish between the functions of photosystem I and photosystem II.   | 4 |
| <br>(b) During your study of <i>Biochemistry</i> , you performed a first-hand investigation that tested the observations of van Helmont, Hales, Priestly, Ingen-Housz, Senebier or Saussure.           |       |  |   |
|  | (i)   | Describe how you performed your investigation, identifying the scientist and the observations you tested.  | 3 |
|  | (ii)  | Identify ONE strength and ONE limitation of your investigation.  | 2 |
|  | (iii) | Explain the importance of the contribution made by your chosen scientist to the overall understanding of plant growth in the seventeenth and eighteenth centuries. | 2 |
| <br>(c) Describe technologies that have made the tracing of biochemical pathways much easier and assess the implications of continued research into photosynthesis for society and/or the environment. |       |  |   |
|  |       |  | 7 |
| <br>(d) (i) Draw a chloroplast as seen under the transmission electron microscope. On your diagram, identify the location of the site of light absorption and the site of the Calvin cycle.            |       |  |   |
|  |       |  | 3 |
|  | (ii)  | Explain why light absorption and the Calvin Cycle occur at these sites.  | 2 |

**End of Question 35****End of Paper**

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Centre Number

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Student Number

**2007 TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION****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 ☒*correct*C ☐D ☐**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"/> |