

Student Number \_\_\_\_\_

Teachers Name \_\_\_\_\_

# ASCHAM SCHOOL

2005

## HSC TRIAL EXAM

# BIOLOGY

### **General Instructions**

- Reading time - 5 minutes
- Working time – 3 hours
- Board-approved calculators may be used
- Write using blue or black pen
- Draw diagrams using pencil

### **Section 1**

Total marks (75)

This section has two parts, Part A and Part B

**Part A** - multiple choice - total marks (15)

- \* Attempt questions 1 - 15
- \* Allow 30 minutes for this part

**Part B** – short answer & extended response questions - total marks (60)

- \* Attempt all questions
- \* Allow about 1 hour and 45 minutes for this part

### **Section II**

Total marks (25)

- \* Attempt ONE question from questions 31-35
- \* Allow about 45 minutes for this part

## Section 1

### PART A

Total marks (15)

Attempt Questions 1 - 15

Allow 30 minutes for this part

Use the 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

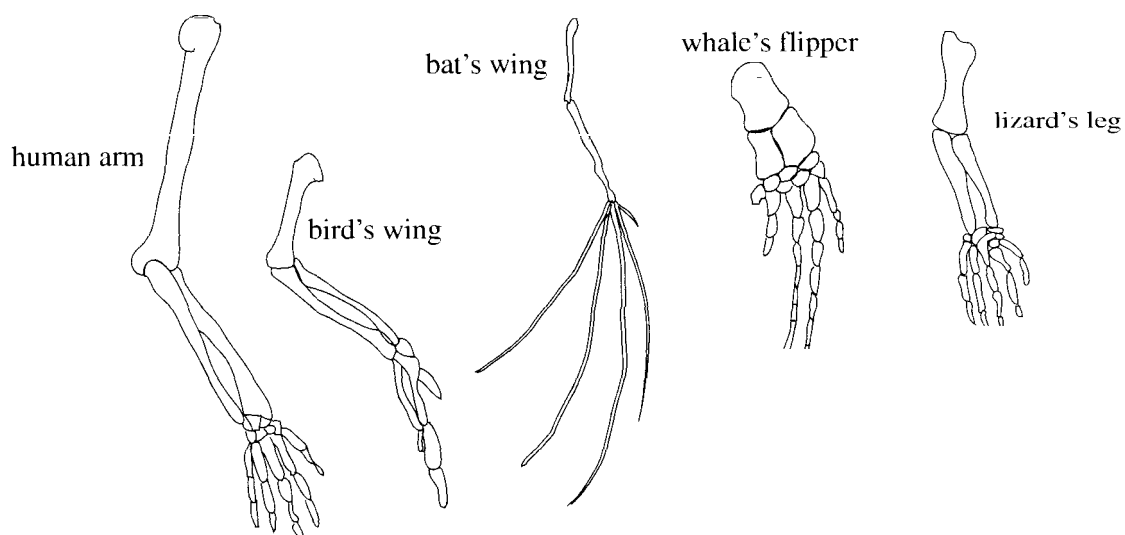
A  B  C  D

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

A  B  C  D

*correct* ↗

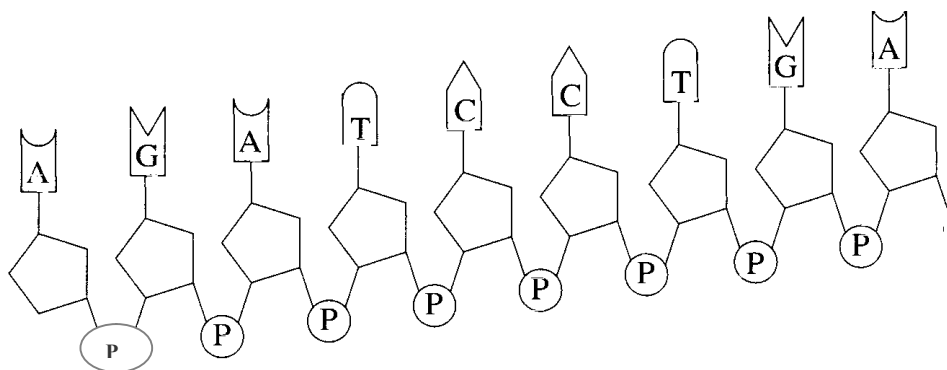
Q1. The diagram below shows the forelimbs of several different vertebrates.



Identify the form of evidence shown in the above diagram.

- (A) Evidence for evolution from paleontology.
- (B) Transitional forms in limbs of vertebrates.
- (C) Comparative embryology.
- (D) Evidence for evolution from homologous structures

**Q2.** The diagram below represents a single strand of DNA ready for protein synthesis.



Reading the DNA from left to right, what will be the correct mRNA sequence for this section of DNA?

- (A) T-C-T-A-G-G-A-C-T
- (B) A-G-A-U-C-C-U-G-A
- (C) U-C-U-A-G-G-A-C-U
- (D) A-G-A-T-G-G-T-G-A

**Q3.** The following lists some of the steps in meiosis, Crossing over also occurs during meiosis. Which step occurs first AFTER crossing over?

- (A) All chromosomes duplicate
- (B) Homologous chromosomes pair up.
- (C) Homologous chromosomes separate
- (D) Chromatids separate

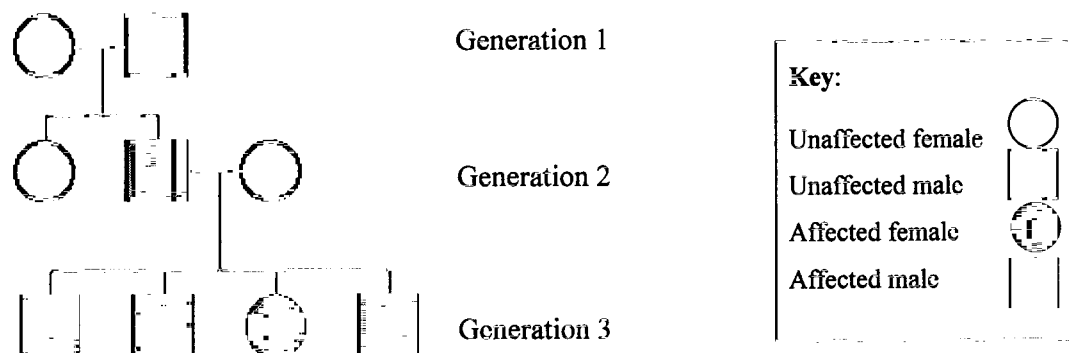
**Q4.** Read the following passage:

*"In theory you could make a new individual by taking the genetic material of an endangered animal and placing it inside an egg whose own nucleus had been removed. This could then be stimulated to form an embryo, which you could in turn implant into a surrogate mother."* New Scientist 19 June 2004 page 36.

What name is given to the process described in the above paragraph?

- (A) Production of a hybrid
- (B) Production of a transgenic species
- (C) Production of a clone
- (D) Production of a mutant.

- Q5.** The pedigree shown below traces the occurrence of an inherited disease through three generations.



Which statement best describes the occurrence of this disease?

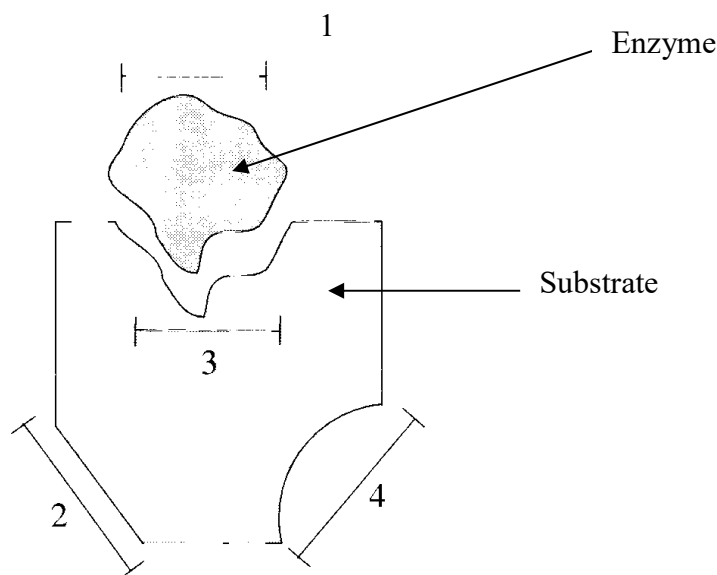
- (A) The gene for this disease is recessive because generation 1 does not show the phenotype.
- (B) Males are expected to have this disease more frequently.
- (C) Females can never inherit this disease
- (D) The gene for this disease is dominant because most offspring show the characteristic.
- Q6.** Which of these statements best describes the concept of *punctuated equilibrium* in evolution?
- (A) Changes in species occur in relatively rapid bursts, followed by longer periods of stability.
- (B) Species gradually change over very long periods of time
- (C) Whole species can become extinct due to environmental change
- (D) New species arise when two unrelated organisms reproduce to produce fertile offspring
- Q7.** Which of the following statements most accurately describes Beadle and Tatum's 'one gene-one enzyme' hypothesis?
- (A) There is only one type of gene in cells that codes for enzymes.
- (B) There exists a one-to-one relationship between a gene and the enzyme produced by that gene.
- (C) Enzymes only act when stimulated by their corresponding gene.
- (D) If a gene is changed by radiation, the enzyme produced by that gene can still be produced.

- Q8.** In 1910, a geneticist called Morgan worked with a mutation that arose in his fruit fly stocks. This mutation caused a white eye instead of the normal red eye colour. He crossed a white-eyed male fly with a normal, red-eyed female. All the first generation had red eyes. However, in the second generation all the females had red-eyes, but half the males had white eyes.

Through further breeding, Morgan eventually got females with white eyes as well. This surprised Morgan, and he carried out a reciprocal cross i.e. he crossed a white-eyed female with a red-eyed male. He found that all the female offspring in the first generation were red-eyed, whereas all the male offspring were white-eyed. In the second generation half of the offspring of each sex were red-eyed, and half were white-eyed.

How did Morgan try to explain these results?

- (A) He reasoned that the gene for eye colour in fruit flies was co-dominant.  
 (B) He explained that the gene for eye colour was located on the X chromosome.  
 (C) He stated that there was no pattern in the inheritance of eye colour in fruit flies.  
 (D) He explained that this pattern of inheritance was due to a mutation in the first generation of flies.
- Q9.** The diagram below shows an enzyme and a substrate.



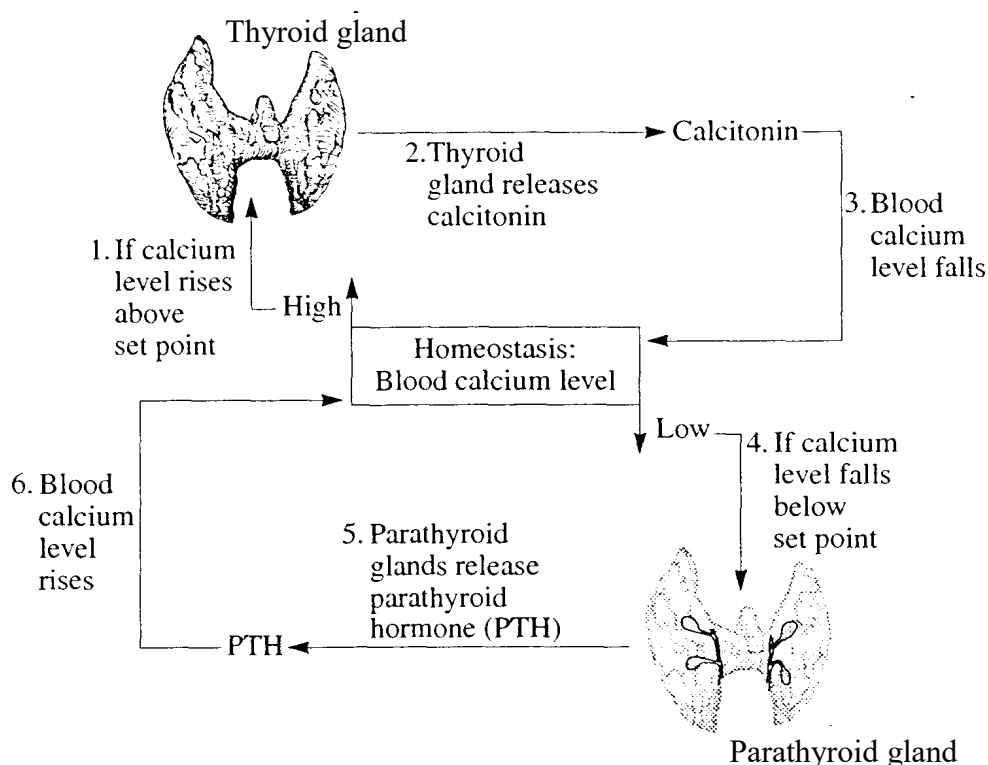
Which number correctly identifies the active site?

- (A) 1  
 (B) 2  
 (C) 3  
 (D) 4

**Q10.** A student in a laboratory bubbles carbon dioxide into a beaker containing water. Which of the following describes how this would affect pH?

- (A) It would lower the pH
- (B) It would rise the pH
- (C) It would cause the pH to reach zero
- (D) There would be not effect on pH

**Q11.** The diagram below describes an example of homeostatic regulation by feedback.



From the information in the diagram, which of the following statements is correct?

- (A) PTH causes a decrease in the blood calcium level.
- (B) Release of PTH is triggered by low levels of calcitonin in the blood.
- (C) Calcitonin and PTH are hormones with opposing actions.
- (D) Destruction of the thyroid gland would result in abnormally low levels of calcium in the body.

**Q12.** What do we call the process by which organisms maintain a constant internal environment?

- (A) enantiostasis
- (B) homeostasis
- (C) osmosis

(D) feedback

**Q13.** The table below provides information about human blood vessels.

<b>P</b>	<b>Q</b>	<b>R</b>
<ul style="list-style-type: none"> <li>• Carry deoxygenated blood back to the heart</li> <li>• Valves ensure the one-way flow of blood</li> </ul>	<ul style="list-style-type: none"> <li>• Thicker, muscular and more elastic walls to withstand high blood pressure</li> </ul>	<ul style="list-style-type: none"> <li>• Gases and nutrients pass through the thin walls to cells</li> </ul>

The blood vessels represented by **P**, **Q**, **R** respectively are:

- (A) capillaries, arteries and veins
- (B) veins, capillaries, arteries
- (C) arteries, veins, capillaries
- (D) none of the above

**Q14.** Which of the following does NOT contribute to the flow of water up a plant stem?

- (A) Guard cells becoming turgid allowing stomates to open.
- (B) Cohesion between water molecules
- (C) Adhesion between water molecules and cellulose phloem walls
- (D) High water concentration in soil spaces.

**Q15.** Why does Australia have such strict quarantine laws?

- (A) to prevent the introduction of disease into the country from overseas.
- (B) to prevent the importation of cheap produce from overseas
- (C) to protect Australian industry from overseas markets
- (D) to prevent foreign organisms breeding with Australian wildlife

**Part B**

Student Number \_\_\_\_\_  
Teachers Name \_\_\_\_\_

**Total marks (60)**

**Attempt all questions**

**Allow about 1 hour and 45 minutes for this section.**

**Answer the questions in the spaces provided.**

**/30 marks**

**Question 16. (3 marks)**

**Marks**

- (a) Name ONE species that can be used as an example of how an environmental change can lead to changes in a species.

**1**

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- (b) Explain how this species has changed as the result of changes in its environment.

**2**

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**Question 17. (3 marks)**

- a) Outline ONE experiment carried out by Gregor Mendel.

**1**

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- b) Explain TWO aspects of the experimental techniques used by Mendel that lead to his success

**2**

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**Question 18.** (3 marks)

**Marks**

The tortoiseshell cat has a combination of black and orange fur. The gene for black fur is represented by  $X^b$  and the gene for orange fur is represented by  $X^o$ .

**3**

If a tortoiseshell female cat ( $X^b X^o$ ) mates with an orange male cat ( $X^o Y$ ) what are the probable percentages of coat colours in the litter of kittens? (show all working)

**Question 19.** (2 marks)

Use a named example to describe how ONE advance in technology has changed scientific thinking about evolutionary relationships

**2**

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**Question 20.** (2 marks)

**Marks**

Cloning is a technique that could be used to increase numbers in an endangered species. Explain the effect cloning would have on the genetic diversity of a species?

**2**

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**Question 21.** (3 marks)

An important feature of genetic material is that it can replicate itself exactly.

(a) Explain how the structure of DNA enables the genetic material to be replicated exactly.

**2**

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(b) If DNA replicates itself exactly during gamete formation, what is ONE other event during this process that ensures variability in characteristics of offspring?

**1**

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**/30 marks**

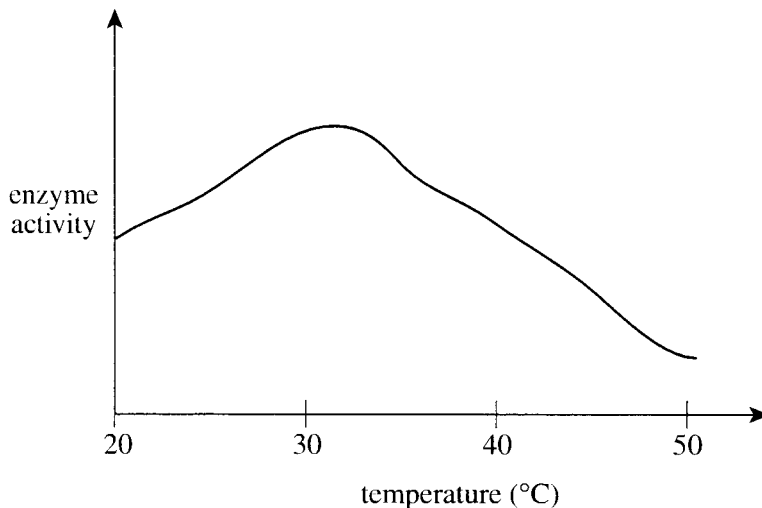
Student Number \_\_\_\_\_

Teachers Name \_\_\_\_\_

**Question 24.** (4 marks)

**Marks**

The following graph shows an enzyme (rennin) catalysing a substrate. The temperature increases from 20°C to 50°C over 20 minutes.



(a) State the temperature that you consider optimum for this enzyme in terms of activity. **1**

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(b) Name another factor that can affect enzyme activity. **1**

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(c) Describe what may be happening to the enzyme's structure above 45°C. **2**

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**Question 25.** (2 marks)

Explain why the removal of CO<sub>2</sub> from cells is essential. **2**

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**Question 26.** (4 marks)

**Marks**

Explain the changes that would have to occur in the functioning of a kidney in a fish as it migrated from the ocean up a fresh water river to lay its eggs.

**4**

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**Question 27.** (7 marks)

Blood is responsible for the movement of many substances around the mammalian body. One unique property of mammalian blood is the presence of haemoglobin to transport oxygen.

(a) Identify two products that are currently extracted from donated blood. **2**

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(b) Discuss the usefulness of ONE of the products named in part (a). **3**

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(c) Explain the adaptive advantages that haemoglobin provides for mammals. **2**

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**Question 28.** (2 marks)

**Marks**

With the aid of a table contrast the processes of active and passive transport

**2**

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**Question 29.** (5 marks)

**Marks**

In your biology course you undertook a first hand investigation to demonstrate the effect of dissolved carbon dioxide on the pH of water

(a) Describe the control in the procedure that you performed.

**1**

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(b) Explain why controls are use in experimental procedures.

**2**

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(c) Identify TWO variables that must be controlled in your procedure.

**1**

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(d) How did you ensure that your results were reliable in your procedure?

**1**

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**Section 11 – Options****Total marks (25)****Attempt ONE question from Questions 31-35****Allow about 45 minutes for this section.**Answer the question in the writing booklet supplied

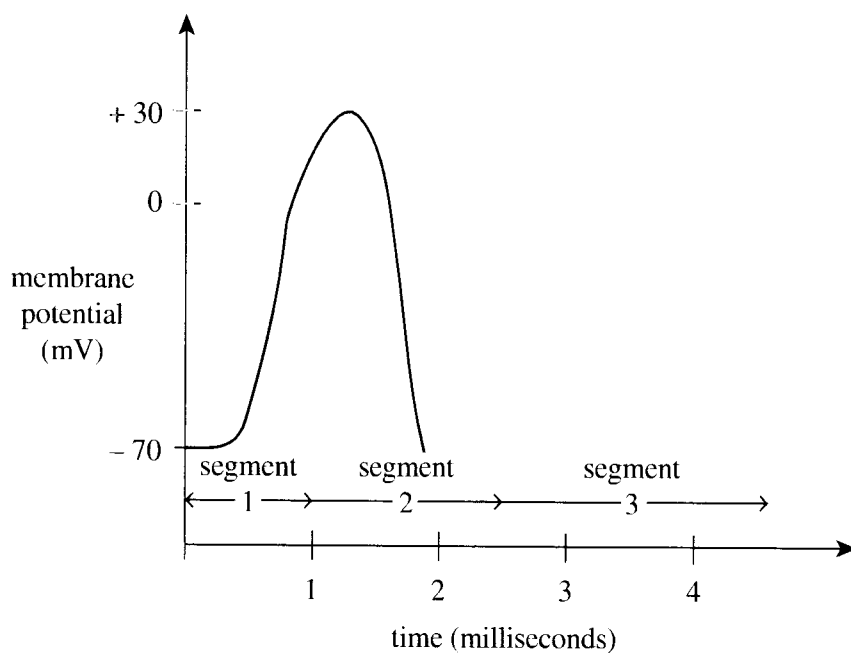
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		<b>Pages</b>
<b>Question 31</b>	<b>Communication</b>	<b>18</b>
<b>Question 32</b>	<b>Biotechnology</b>	<b>20</b>
<b>Question 33</b>	<b>Genetics: the broken code</b>	<b>21</b>
<b>Question 34</b>	<b>The Human Story</b>	<b>22</b>
<b>Question 35</b>	<b>Biochemistry</b>	<b>23</b>

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

- (a) (i) The involvement of the senses in communication can be explained by the "stimulus-response model". Explain this model. **2**
- (ii) The location and structure of the receptor cells in a sense organ is tremendously important. It enables the organ to perform its primary function of detecting stimuli. Justify this statement by referring to the eye. **3**

(b) The following graph represents a typical action potential.



Identify the name of the processes that are occurring in segment 1 and 2 and considering the net movement of potassium and sodium ions, give the direction (in or out) for each ion in these segments.

**(Draw a table, similar to the one below in your answer book with your correct response.)** **2**

<i>Segment</i>	<i>Name of process</i>	<i>Sodium</i>	<i>Potassium</i>
<i>1</i>			
<i>2</i>			

- (c) In your study of this topic you performed a first-hand investigation of the mammalian eye in order to determine the relationship between structure and function of its parts. **Marks**

Draw a table including information which shows this relationship for the following parts of the eye:

3

- iris
- lens
- vitreous humour

- (d) The following is a diagram of the human ear.



- (i) In your answer book, clearly identify structures 1, 2, 3 and 4. **2**
- (ii) If structure I was damaged, identify and evaluate a current technology that could be used to assist that person in hearing. **4**
- (d) Give a detailed account of how structures in humans allow for the production of the range of sounds of which humans are capable. **3**
- (e) Justify ONE technology that would be used to correct each of the following: **6**
- i) cataracts,
  - ii) myopia
  - iii) hyperopia.

**End of Question 31**

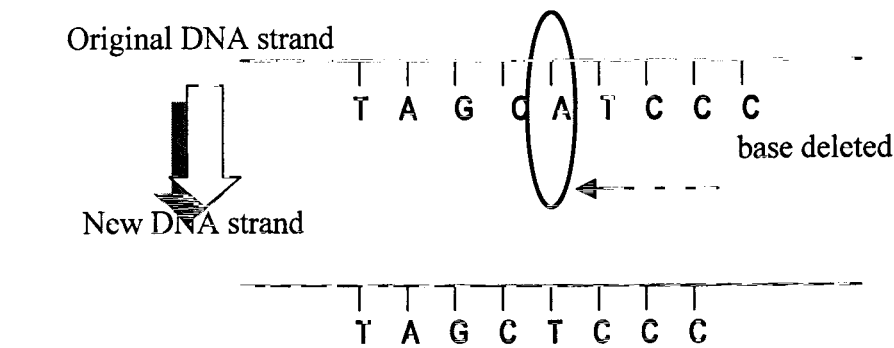
**Question 32 - Biotechnology (25 marks)****Marks**

- (a) Draw a flow chart to show the sequence of events that results in the formation of recombinant DNA. 3
- (b) Changes in technology and scientific knowledge have modified traditional uses of biotechnology.
- (i) Choose ONE example of a traditional use of biotechnology and explain the process involved. 2
- (ii) Explain how technology and scientific knowledge have modified this use of biotechnology. 3
- (c) Different groups in society may have different views about the use of DNA technology.
- (i) State what these different views might be, giving reasons for the differences. 2
- (ii) Explain why such differences exist. 3
- (d) Choose ONE of the following:
- the production of monoclonal antibodies
  - OR
  - recombinant vaccines to combat virulent animal diseases.
- (i) Name your choice and the plant(s) or animal(s) involved in it. 1
- (ii) Describe the process involved and the outcomes of the process. 4
- (e) During your study of Biotechnology you gathered and analysed information to present a case study on the application of biotechnology in medicine.
- (i) Name the application and describe the process used. 4
- (ii) Evaluate the advantages and disadvantages associated with the process. 3

**End of Question 32**

**Question 33 - Genetics: The Code Broken? (25 marks)****Marks**

- (a) The diagram below shows a section of DNA that codes for a polypeptide.



- (i) Name the base represented by the letter A. 1
- (ii) Outline how this mutation will affect the polypeptide produced by this gene. 2
- (b) Mendel discovered that the characteristic of tallness (T) was dominant over the characteristic of shortness (t) in pea plants and that yellow flower (Y) was dominant over green flower (y).
- (i) Determine the offspring produced when a pure (homozygous) tall pea plant with green flowers is crossed with a pure (homozygous) short pea plant with yellow flowers. Show all working in your answer. 4
- (ii) How would the offspring be affected if the genes for both these characteristics were found on the same chromosome? 1
- (c) (i) Outline the procedure used to produce recombinant DNA. 3
- (ii) Explain how recombinant DNA technology can be used to determine the position of a gene on a chromosome. 3
- (d) (i) Outline how information on a section of DNA is transferred to RNA. 2
- (ii) Explain how RNA determines the type of polypeptide formed. 3
- (e) During your study of this option you carried out an investigation into the cloning of an animal. Describe the process of cloning a named animal and explain how scientists verify that the animal produced was a clone.

**End of Question 33**

**Question 34 - The Human Story (25 marks)****Marks**

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|------------|--|---|
| <b>(a)</b> | (i) Distinguish between relative and absolute dating of fossils.   | 1 |
|            | (ii) Describe ONE example of a relative dating technique for fossils.  | 1 |
|            | (iii) Describe ONE example of an absolute dating technique for fossils.  | 1 |
| <b>(b)</b> | (i) Name TWO fossils used in studying human evolutionary relationships.  | 2 |
|            | (ii) Describe a physical similarity and a physical difference between the two fossils you named. Explain how these observations relate to tracing human evolutionary relationships.  | 3 |
| <b>(c)</b> | (i) Describe a cultural change that occurred as humans developed into efficient hunters in organised co-operative groups.  | 2 |
|            | (ii) Discuss possible impacts of the cultural change you described.  | 3 |
| <b>(d)</b> | (i) Outline ONE example of polymorphism in humans, and analyse the evolutionary significance of TWO different phenotypes from this example.  | 2 |
|            | (ii) Identify the evolutionary value of human polymorphism.  | 1 |
|            | (iii) Analyse the possible effects of genetic engineering on human polymorphism.   | 2 |
| <b>(e)</b> | During your study of 'The Human Story' you carried out investigations about the classification of primates.  |   |
|            | (i) Identify a specific data source you used (other than information given by a teacher) to study the classification of primates.  | 1 |
|            | (ii) Describe ONE similarity and ONE difference between humans and monkeys.  | 2 |
|            | (iii) Identify a technological advance and outline the new information it produced in relation to primate classification. Explain how this new information changed scientists' ideas about the classification of primates. | 4 |

**End of Question 34**

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

- (a) (i) Represent photosynthesis using a scientific equation. 2
- (ii) Identify TWO reasons for studying photosynthesis. 2

- (b) The table below shows a relationship between light intensity and rate of photosynthesis.

Light intensity	Relative Rate of Photosynthesis
0	0
500	38
1000	50
1500	56
2000	56

- (i) Describe the relationship between light intensity and rate of photosynthesis given in the table above. 2
- (ii) Sketch the information given in the table. 1
- (iii) What is the significance of the shape of the curve you have sketched? 2
- (c) Construct a timeline that indicates the improvements in microscopy that would have assisted Englemann in his work with Spirogyra. 4
- (d) Outline the main steps of the Calvin cycle. 5
- (e) Discuss the potential use of photosynthesis in replacing THREE named materials presently obtained from other non-renewable resources 7

**End of Question 35**

**BIOLOGY HSC TRIAL EXAM - 2005**

<b>SECTION</b>	<b>MARK</b>	<b>COMMENTS</b>
<b><u>Section I</u></b>  <b>Part A -</b> multiple choice - total marks <b>(15)</b>		
<b><u>Section I</u></b>  <b>Part B –</b> short answer & extended response questions – total marks <b>(60)</b>		
<b><u>Section II</u></b>  <b>Option –</b> Communication – total marks <b>(25)</b>		
<b>TOTAL</b> <b>(100)</b>		



ASCHAM HSC Trial Examination 2005

Biology

DIRECTIONS:

Write your name in the space provided.

Write your student number in the slots provided below as indicated by the large arrow. Then, in the columns of digits below each box, fill in the oval which has the same number as you have written in the box. Fill in **one** oval only in each column.

Read each question and its suggested answers. Select the alternative A, B, C, or D that best answers the question. Fill in the response oval completely, using blue or black pen. Mark **only one** oval per question. If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer. If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and draw an arrow as shown on page 2 of your examination paper.

TEACHERS NAME: \_\_\_\_\_

STUDENT NUMBER:

1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9
0	0	0	0	0	0	0	0	0

PART A  
ANSWER SHEET

- 1. A  B  C  D
- 2. A  B  C  D
- 3. A  B  C  D
- 4. A  B  C  D
- 5. A  B  C  D
- 6. A  B  C  D
- 7. A  B  C  D
- 8. A  B  C  D
- 9. A  B  C  D
- 10. A  B  C  D
- 11. A  B  C  D
- 12. A  B  C  D
- 13. A  B  C  D
- 14. A  B  C  D
- 15. A  B  C  D

STUDENTS SHOULD NOW CONTINUE  
WITH PART B