SYDNEY GRAMMAR SCHOOL

2003
FORM VI
HSC TRIAL EXAMINATION

Biology

General Instructions

- Working time – 3 hours
- Board-approved calculators may be used
- Write using blue or black pen
- Draw diagrams using pencil
- Write your Candidate Number at the top of each page of Part B

Section I Pages 2 - 20

Total marks: 75

This section has two parts, Part A and Part B

Part A
Total marks: 15
- Attempt Questions 1 to 15
- Allow about 25 minutes for this Part

Part B
Total marks: 60
- Attempt Questions 16 to 28
- Allow about 1 hour 45 minutes for this Part

Section II Pages 21 - 23
Total marks: 25
- Attempt ONE Question from Option Questions
- Allow about 45 minutes for this Section

CHECKLIST	
Each boy should have the following:	
1 Question Paper	
1 Multiple-choice Answer Sheet	
1 4-page Writing Booklet	

Part A

Total marks: 15
Attempt Questions 1 to 15
Allow about 25 minutes for this Part

Use the multiple-choice Answer Sheet supplied.

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

Sample 2 + 4 =

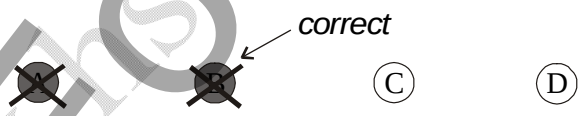
(A) 2 (B) 6 (C) 8 (D) 9

Ⓐ ● Ⓒ Ⓓ

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 drawing an arrow as follows.



1 Kangaroos lick their forelimbs to achieve heat loss through evaporation. This is an example of which of the following?

(A) homeostasis
(B) osmoregulation
(C) behavioural adaptation
(D) ectothermy

2 In which of the following ways is the majority of carbon dioxide carried in human blood?

(A) hydrogen carbonate ions
(B) carbaminohaemoglobin
(C) dissolved directly in plasma
(D) free gas bubbles

3 Which of the following is the process by which nutrients are reabsorbed from the nephron into the surrounding capillaries?

(A) deamination
(B) filtration
(C) active transport
(D) osmosis

4 Insulin is one of the simplest proteins synthesised by the human body. It consists of a polypeptide chain of 51 amino acids. How many bases in a DNA molecule are required in order to code for this protein?

(A) 51
(B) 153
(C) 102
(D) 26

5 Using Snapdragons, homozygous white flowering plants were crossed with homozygous red flowering plants. All of the F1 plants had pink flowers. Possible genotypes for these plants (in named order) would be:

(A) WR,RR, RR
(B) WR,WW,WR
(C) WW,RR,RW
(D) WR,RW,WW

6 Which of the following best describes the chemical composition of an enzyme?

(A) polypeptide
(B) protein
(C) nucleic acid
(D) trigylceride

7 Which of the following best describes the effect of very cold temperatures on the structure or activity of an enzyme?

(A) The enzyme structure is denatured.
(B) The enzyme activity increases.
(C) The enzyme activity is temporarily inhibited.
(D) The enzyme structure is temporarily altered.

8 When frog DNA was analysed 26% of the bases were cytosine. What would be the expected percentage of adenine?

(A) 24%
(B) 26%
(C) 48%
(D) 52%

9 Human skin adapts to exposure to UV radiation by producing more melanin and becoming suntanned. How can this observation be explained?

(A) The environment is affecting phenotype.
(B) The environment is affecting genotype.
(C) The environment affects the rate of meiosis in skin cells.
(D) The environment is acting as a selection agent.

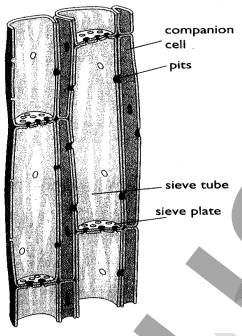
10 Which of the following is the best definition of *enantiostasis*?

(A) The maintenance of metabolic functions in response to environmental change.
(B) The maintenance of physiological functions in response to environmental change.
(C) The maintenance of a healthy organism in response to environmental variation.
(D) The maintenance of metabolic and physiological functions in response to variations in the environment.

11 Which of the following is **not** a response shown by some plants to an increase in the ambient (surrounding) temperature?

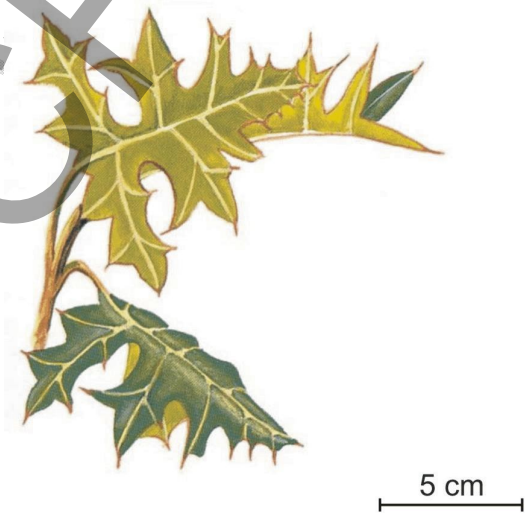
(A) increased transpiration
(B) decreased translocation
(C) closing of the stomates
(D) loss of leaves

12 The following diagram represents part of a plant. Which of the following correctly identifies the tissue drawn?



(A) xylem
(B) phloem
(C) epidermis
(D) cambium

13 Below is a drawing of a section from an Australian plant. Which of the following correctly identifies the adaptation shown by this plant to minimise water loss?



(A) Reduced surface area
(B) Small leaves
(C) Fleshy leaves
(D) No leaves stem used for photosynthesis.

14 Which the following processes could be used to produce a transgenic organism?

(A) artificial insemination
(B) artificial pollination
(C) whole organism cloning
(D) plasmid vectors

15 How would the genetic diversity of a agricultural food crop be affected by the introduction and extensive use of cloning?

(A) The genetic diversity would be increased.
(B) The genetic diversity would be decreased.
(C) The genetic diversity would be unchanged over time.
(D) The genetic diversity would increase at first and then decrease.

Class

Candidate Number

Part B

Total marks: 60
Attempt Questions 16 to 28
Allow about 1 hour 45 minutes for this Part

Answer the questions in the spaces provided.
Show all relevant working in questions involving calculations.

Marks

Question 16 (5 marks)

Homeostasis can be said to consist of two stages: **5**

- detecting changes from the stable state.
- counteracting changes from the stable state.

Discuss this statement with reference to a named example.

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Class

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Question 17 (3 marks)

Describe three processes involved in the production and maintenance of the transpiration stream in flowering plants. **3**

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Class

Candidate Number

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Question 18 (4 marks)

In calico cats, the allele X^B produces black fur colour and the allele X^L produces yellow fur. These alleles show co-dominance and the hybrid form produces tortoiseshell fur colour. The genes are sex-linked.

A black female cat was mated with a yellow male cat and several offspring were produced. State the genotypes of the parents and the phenotypes (including sex) of all possible offspring. Show your working. **4**

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Class

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Question 19 (6 marks)

Compare the structure of arteries and veins in relation to how blood is moved through them. **6**

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Class

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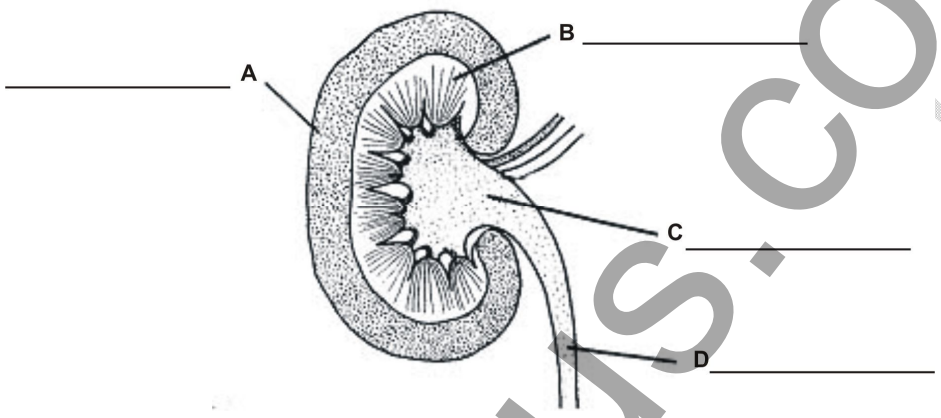
Question 20 (4 marks)

(a) Identify the parts labelled A, B, C and D on this diagram of the internal structure of a human kidney. **2**



(b) Identify the main function of: **2**

(i) part A

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(ii) part B

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Class

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Class

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Question 21 (4 marks)

Outline the need for oxygen in living cells and explain the adaptive advantage of haemoglobin in the circulatory system of a mammal. **4**

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Question 22 (2 marks)

Explain why the removal of carbon dioxide from the cells of an organism is essential for its survival. **2**

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Class

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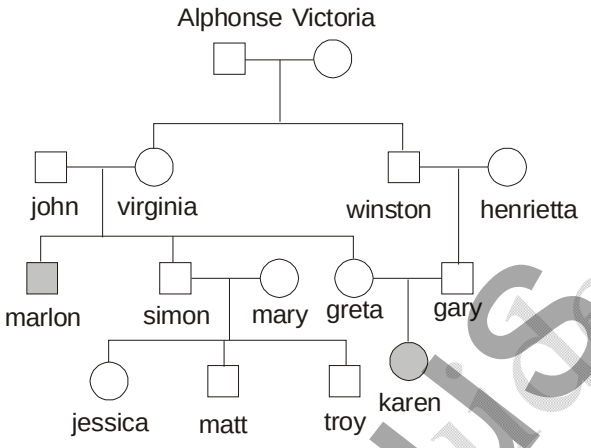
Question 23 (5 marks)

Study the human pedigree for the inheritance of the disease *phenylketonuria* (PKU).



(a) Using the symbols N = normal and n = PKU, state the genotypes of: **2**

(i) john

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(ii) marlon

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(b) Explain why the mutation causing this disease probably occurred in either Alphonse or Victoria rather than in a later generation. **2**

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Question 23 continues on page 16

Class

Candidate Number

Marks

Question 23 (continued)

(c) State the probability of a second child of Greta and Gary inheriting the allele. *(show working)* **1**

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Question 24 (4 marks)

There are many theories to explain the considerable diversity of life on Earth.

In an experiment on the effects of an insecticide on flea infestations of a domestic dog, it was found that after the first two treatments the insecticide was effective. However, after some months, a third treatment was less effective and many fleas remained alive. **4**

Give a reasoned scientific explanation for theses observations.

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Class **Marks**

Candidate Number

Question 25 (8 marks)

DNA is a complex molecule found in almost all living organisms.

(a) Use a labelled diagram to illustrate the process of DNA replication. **3**

(b) Name a mutagen. **1**

…….

(c) Draw a simple flow chart to illustrate how changes in DNA structure can result in changes in cell activity. **4**

Class

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Question 26 (5 marks)

Describe a first-hand investigation that you have performed to demonstrate the effect of changes in temperature on the activity of an enzyme. **5**

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Question 27 (3 marks)

Draw a labelled diagram to illustrate a simple model for the specificity of enzymes to their substrate. **3**

Class

Candidate Number

Marks

Question 28 (7 marks)

Using specific examples, describe how the Theory of Evolution is supported by: **7**

- palaeontology
- comparative anatomy
- biogeography

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Section II

Total marks: 25
Attempt ONE question from Questions 29 - 33
Allow about 45 minutes for this section

Answer the question in a writing booklet. Extra writing booklets are available.

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Class

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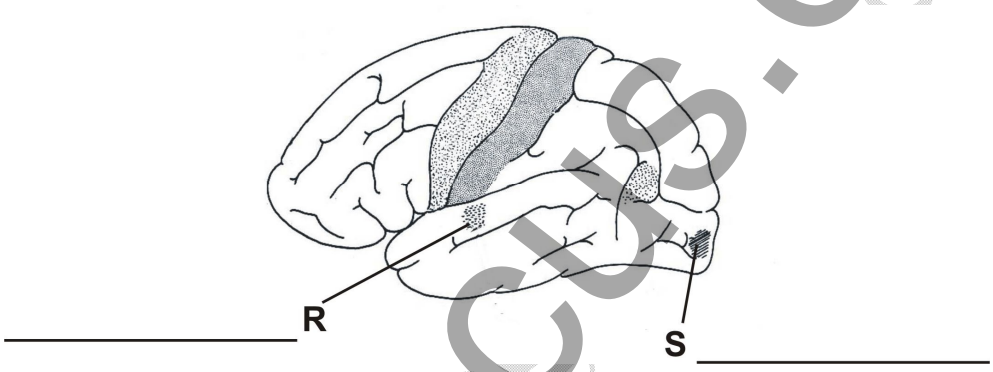
Question 29 – Communication (25 marks)

(a) (i) Where is the vitreous humour located in the eye? You may draw a labelled sketch of the eye if you wish. **1**

(ii) On the diagram of the brain below state the functions of the areas labelled R and S. **2**



(b) (i) How would you gather information on the wavelengths of the electromagnetic spectrum which can be detected by animals other than humans? In your answer explain how you would assess the reliability of the information that you had collected. **2**

(ii) Draw a detailed diagram to show how the lens of the eye refracts light onto the fovea. **2**

(c) Outline the structure of the human larynx and the associated structures that assist the production of intelligible sounds. In your answer explain how each structure helps to produce the sounds. **5**

(d) Describe one technology which is used to help a named visual impairment and one technology which is used to overcome a named auditory impairment. In your answer you should clearly explain the defect, how it affects the sufferer and how the technology helps to overcome the defect. **6**

(e) Explain the role of the photoreceptors in vision. **7**

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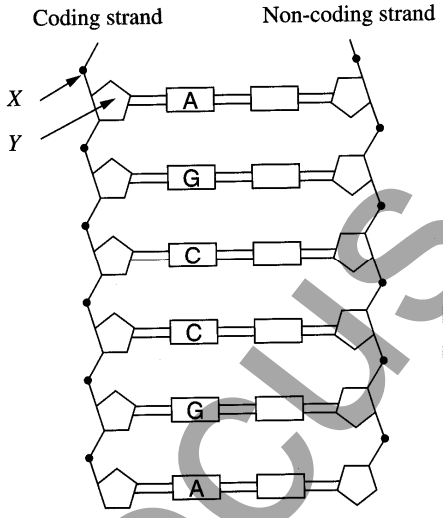
Question 31 Genetics – The Code Broken? (25 marks)

(a) The diagram shows a simplified model of a DNA molecule.



(i) Identify the chemical substances represented by X and Y **1**

(ii) Reading from the top downwards, this section of DNA would code for the amino acid sequence *Serine – Arginine*. State the anti-codon triplets found on those tRNA molecules that mobilize Serine and Arginine. **2**

(b) Is it possible for a female with blood type A and a male with blood type B to have children with four different blood types? Show working. **2**

(c) Describe the evidence which indicates the presence of ancestral vertebrate gene homologues (homologous genes) in lower animal classes such as insects. **2**

(d) In pea plants, the allele for green seeds (G) is dominant to the allele for yellow seeds (g). The allele for tall plants (T) is dominant to the allele for short plants (t). Pure breeding tall/green plants were crossed with pure breeding yellow/short plants to produce the heterozygous F1 generation. These F1 plants were then crossed to produce the F2 generation. **5**

Predict the difference in the phenotype ratio of the F2 generation if (i) the alleles for colour and height are independently inherited; and (ii) the alleles for colour and height are linked. *(show working)*

(e) Using one specific example, describe the effect of a named and/or described genetic mutation on human health. **6**

(f) Distinguish between gene cloning and whole organism cloning in terms of the processes and beneficial products. **7**