James Ruse Agricultural High School

2008

HIGHER SCHOOL CERTIFICATE

TRIAL EXAMINATION

BIOLOGY

Total marks - 100

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen

- Draw diagrams using pencil
- Board-approved calculators may be used
- *Write your Exam Number at the top of the pages*

Section I

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

25 marks
- Attempt all parts of this question
- Allow about 45 minutes for this section

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.

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

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 *correct* and drawing an arrow as follows:

correct

A ○ B● C ○ D ○

1. How is the majority of carbon dioxide transported in humans?

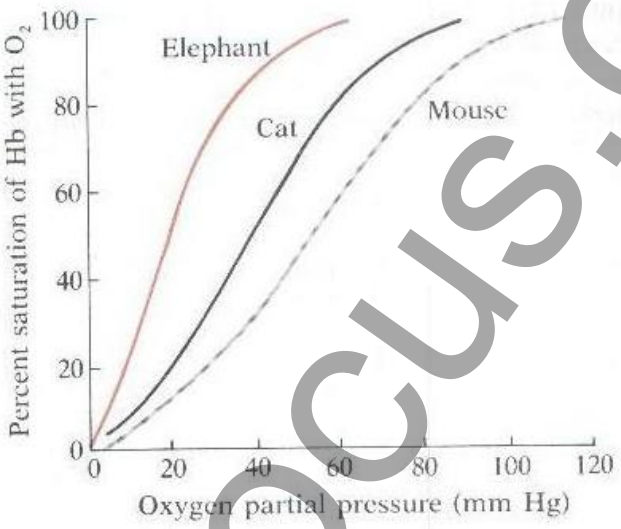
   (A) Dissolved in plasma.

   (B) Bound to haemoglobin.

   (C) In the form of hydrogen carbonate ions dissolved in plasma.

   (D) In the form of chylomicrons released into blood vessels.

2. The oxy-haemoglobin dissociation curves of three different sized animals are displayed in the graph.



What is the order of these animals in terms of the ease of haemoglobin losing oxygen in muscle tissue?

	haemoglobin offloads oxygen more readily	→	haemoglobin offloads oxygen less readily
(A)	elephant	cat	mouse
(B)	mouse	cat	elephant
(C)	cat	elephant	mouse
(D)	elephant	mouse	cat

3. Which regulatory processes explain the differences in the urine excreted by freshwater and marine fish?

	adaptations of freshwater fish	adaptations of marine fish
(A)	diffusion of salts from gills, diffusion of water into fish via gills, active transport of salt into fish via gills	diffusion of salts into gills, diffusion of water from fish via gills, active transport of salt out of fish via gills
(B)	diffusion of salts from gills, active transport of water into fish via gills, active transport of salt into fish via gills	diffusion of salts into gills, active transport of water from fish via gills, diffusion of salt out of fish via gills
(C)	diffusion of salts into gills, diffusion of water from fish via gills, active transport of salt out of fish via gills	diffusion of salts from gills, diffusion of water into fish via gills, active transport of salt into fish via gills
(D)	active transport of salts into gills, diffusion of water from fish via gills, diffusion of salt out of fish via gills	active transport of salts from gills, diffusion of water into fish via gills, diffusion of salt into fish via gills

4. Red-green colour blindness is inherited as a sex-linked recessive condition. If a colour-blind woman marries a man with normal vision, what would be the expected phenotypes of their children?

(A) All of their children will be colour-blind.

(B) 100% of their daughters will be colour-blind.

(C) 100% of their sons will be colour-blind.

(D) About 50% of their sons and 50% of their daughters will be colour-blind.

5. Which scientist is credited with discovering sex-linkage by studying the inheritance of eye colour in fruit flies?

(A) F. C. Crick.

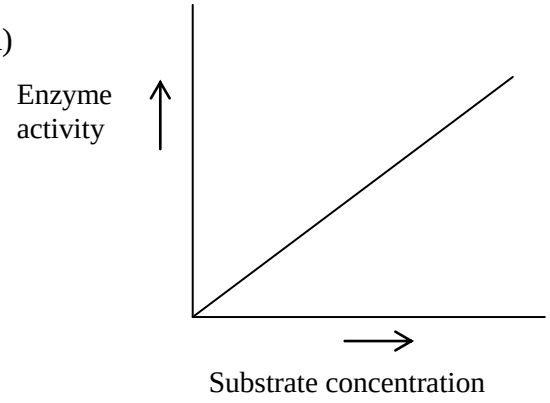
(B) T. H. Morgan.

(C) R. C. Punnet.

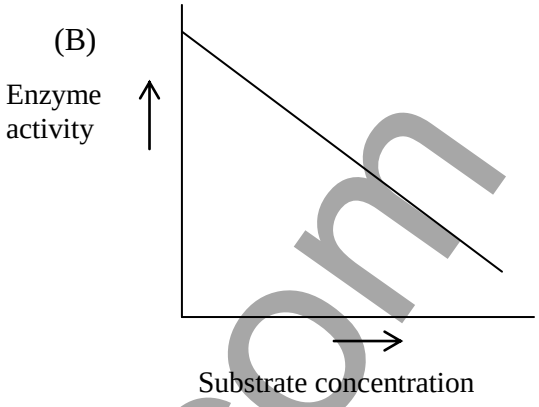
(D) W. S. Sutton.

6. Which graph represents enzyme activity as a function of substrate concentration?

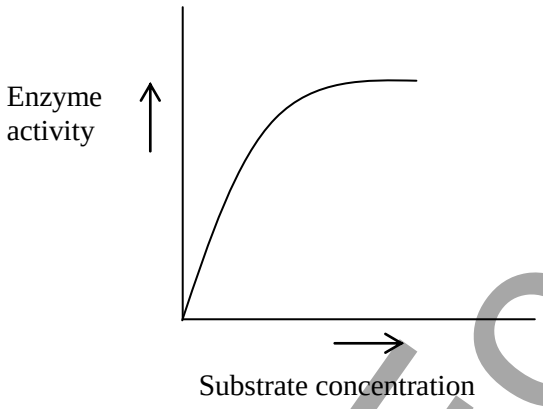
(A)



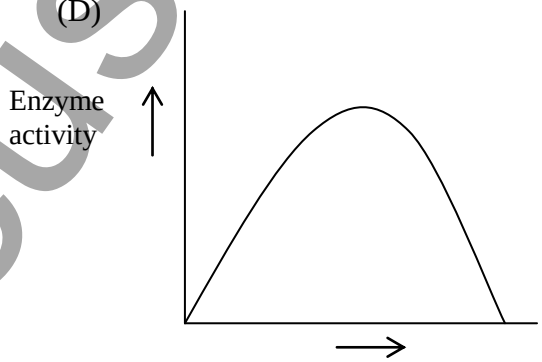
(B)



(C)



(D)



7. Which nitrogenous waste form is the least toxic, may be stored for long periods of time, and requires very little water for excretion?

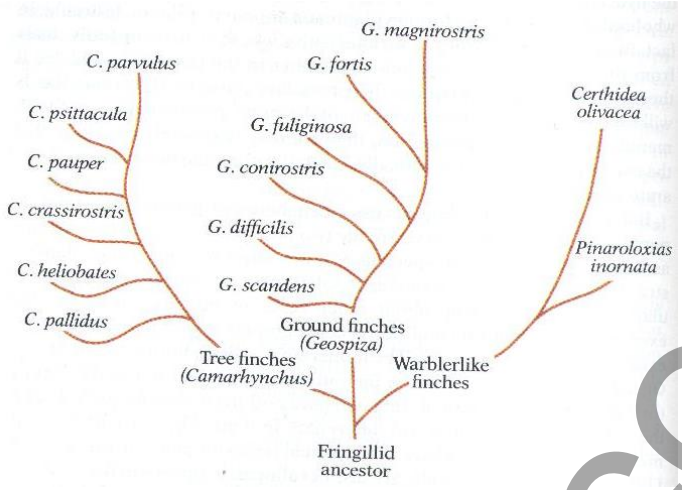
(A) Ammonia

(B) Nitrogenous bases

(C) Urea

(D) Uric acid

8. The evolutionary history of the finches studied by Charles Darwin in the Galapagos Islands is shown in the diagram.



Ground finches feed on hard, large seeds. Tree finches feed on insects and small seeds. Warblers feed on insects.

What type of evolution is shown by the finches?

(A) Convergent evolution

(B) Divergent evolution

(C) Parallel evolution

(D) Punctuated equilibrium

9. Antidiuretic hormone is affected by caffeine and stress: Caffeine inhibits the release of antidiuretic hormone from the pituitary gland, and stress increases the production of antidiuretic hormone. What would be the effects of caffeine and stress in terms of urine output and water level in blood?

	Urine output	Blood water levels
(A)	Caffeine: increases Stress: increases	Caffeine: increases Stress: increases
(B)	Caffeine: decreases Stress: increases	Caffeine: increases Stress: increases
(C)	Caffeine: increases Stress: decreases	Caffeine: decreases Stress: increases
(D)	Caffeine: decreases Stress: decreases	Caffeine: increases Stress: decreases

10. Blue Legged Crabs' haemoglobin equivalent — haemocyanin — does not bind to oxygen as efficiently when the crab is in a low potassium, low sodium environment. In order for the haemocyanin to function efficiently, the crab lowers its internal pH. What form of regulation is this an example of?

(A) Active transport

(B) Enantiostasis

(C) Homeostasis

(D) Passive transport

11. What type of work did Thomas Boveri perform that helped our understanding of inheritance?

(A) He studied the inheritance of genes on the X and Y chromosomes of fruit flies.

(B) He bred pea plants and studied the inheritance of one or two traits in the pea plants.

(C) He studied the inheritance of chromosomes in the daughter cells of horse worm egg cells undergoing meiosis.

(D) He studied red bread mould enzymes, showing that the loss of function in one enzyme led to the loss in function of one enzyme.

12. Coat colours of Andalusian fowls are an example of a trait determined by codominant alleles. Black, blue (a mixture of black and white) and white are the three phenotypes in Andalusian fowls. When blue fowls are crossed with white fowls, what percentage of the F_1 will be blue?

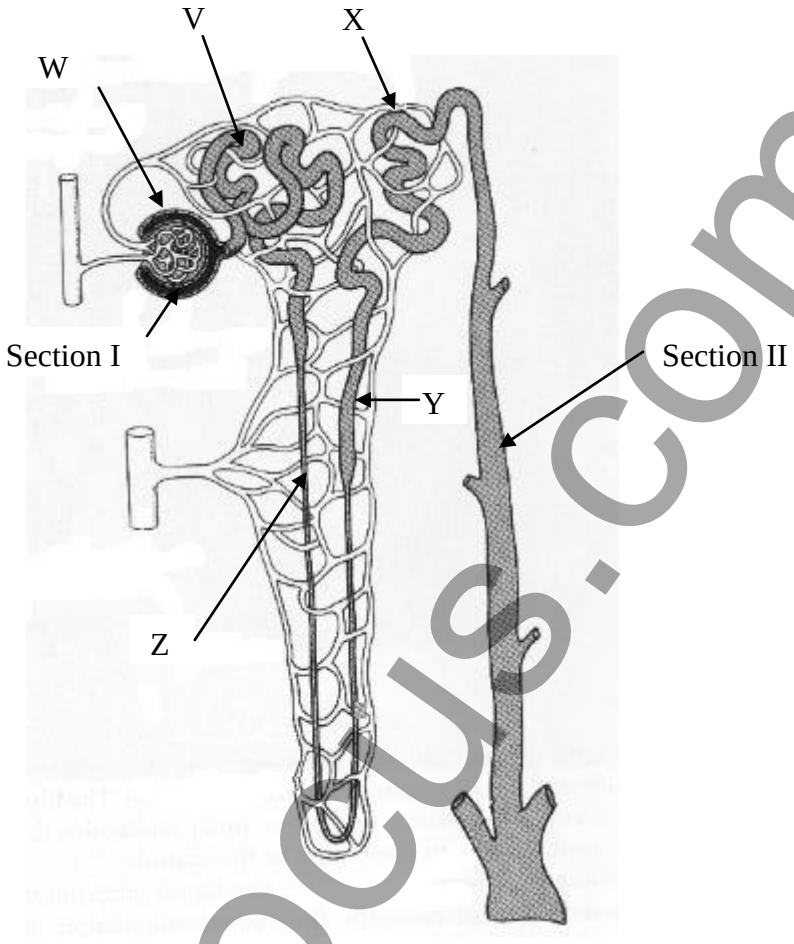
(A) 0%

(B) 25%

(C) 50%

(D) 75%

13. The diagram is a cross-section of a mammalian nephron.



In which segment(s) does the reabsorption of water from the nephron via passive transport occur?

(A) W and Section II

(B) W, X, and Y

(C) V, X, Y, Z and Section II

(D) V, X, Z and Section II

14. What factors are important in the occurrence of an infectious disease besides the direct contact of individuals?

(A) Air, water

(B) Water, chromosomes

(C) Air, water, food

(D) Air, water, food, vectors

15. What is the role of differentiation in maintaining health?

(A) Results in different types of cells having different functions to perform.

(B) Enables certain cells to undergo rapid cell division.

(C) Controls the production of proteins called antibodies.

(D) Programming cell death.

Exam Number

Write your Exam Number at the top of this Part A Answer Sheet.

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

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 ○

Exam Number

Section I (continued)

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

Question 16 (3 marks)

(a) Identify a terrestrial Australian ectotherm. (1 mark)

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(b) Explain the responses of the ectotherm given in (a) to cold and hot environmental temperatures. (2 marks)

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Question 17 (7 marks)

Kidney failure is treated using a renal dialysis machine.

(a) Explain how metabolic wastes are removed via renal dialysis. (2 marks)

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Questions continue on next page →

Question 17 *Continued*

(b) Draw a longitudinal section of a mammalian kidney. Label two regions on your diagram. (3 marks)

(c) Compare the structures of the renal artery and renal vein. (2 marks)

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Question 18 (4 marks)

Unicellular organisms excrete dissolved nitrogenous wastes by the process of diffusion.

(a) Explain why the process of diffusion is inadequate for removing nitrogenous wastes from multicellular organisms. (2 marks)

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Questions continue on next page →

Question 18 *Continued*

(b) Outline the role of active transport in the mammalian kidney. (2 marks)

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Question 19 (5 marks)

The direction of movement of materials transported in the phloem tissue of plants is upwards and downwards from the leaves. Phloem tissue is composed of sieve tube cells and companion cells.

(a) Name a current theory for the movement of materials through phloem tissue. (1 mark)

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(b) Describe the theory you gave in (a). (4 marks)

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Questions continue on next page →

Question 20 (3 marks)

Carbon dioxide is one of the main metabolic waste products.

(a) Describe a current technology that enables the measurement of carbon dioxide concentration in the blood. (1 mark)

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(b) Justify the use of the technology you identified in (b). (2 marks)

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Question 21 (3 marks)

Aldosterone is a hormone secreted from the adrenal glands in humans. People who cannot secrete aldosterone suffer from Addison's disease.

(a) Describe the role of aldosterone in humans. (1 mark)

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Questions continue on next page →

Question 21 *Continued*

(b) Explain how hormone replacement therapy is used to treat people that suffer from Addison's disease. (2 marks)

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Question 22 (4 marks)

In your course you presented a case study that demonstrated the impact of environmental change on the evolution of a species. Outline your case study below. (4 marks)

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Questions continue on next page →

Question 23 (4 marks)

Using a specific example, describe how the study of palaeontology provides evidence for the theory of evolution. (4 marks)

Questions continue on next page →

Question 24 (5 marks)

Natural selection is one mechanism that accounts for Darwin/Wallace's theory of evolution.

(a) Using a modern example, explain how natural selection contributes towards the evolution of an organism. (3 marks)

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(b) Describe the potential role that mutations may have on evolution. (2 marks)

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Questions continue on next page →

Question 25 (5 marks)

Describe the method employed and results obtained for an investigation you conducted that demonstrated the effect of the environment on the phenotype of an organism.
(5 marks)

Questions continue on next page →

Question 26 (3 marks)

(a) Using the symbols provided in the key, construct a pedigree for the inheritance of red hair colour in the Richards family described.

Red hair colour in the Richards family

Mrs Richards is a brown-haired female married to Mr Jones, a brown-haired male. They have three children, a male (Jack) who is red-haired, a male (Mark) who is brown-haired and a female (Jill) who is red-haired. Jack marries a black-haired female and they have one red-haired female, one black-haired female and one red-haired male. Jill marries a brown-haired male and they have three children, two males and a female. All of Jill's children are brown-haired.

Key

 Red-haired male

 brown or black-haired male

 Red-haired female

 brown or black-haired female

(b) State the type of genetic inheritance for red hair colour in the family. (1 mark)

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Questions continue on next page →

Question 27 (5 marks)

The treatment of water for human consumption is an important process for the prevention and control of disease.

(a) Describe two ways by which water is treated for human drinking. (2 marks)

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(b) Describe how you could identify if microbes are present in water sample. (3 marks)

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Questions continue on next page →

Question 28 (2 marks)

The table shows the proportions of nucleotide bases in DNA from a variety of organisms.

organism	adenine	thymine	cytosine	guanine
bacterium	1.1	1.0	2.6	2.6
calf thymus	1.7	1.6	1.0	1.0
yeast	1.8	1.9	1.0	1.0

Explain the significance of these results with respect to the work of James Watson and Francis Crick in the 1950s.

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Questions continue on next page →

Question 29 (7 marks)

Compare the process used to produce transgenic plants with that used to produce transgenic animals. Evaluate the success of these processes. (7 marks)

Questions continue on next page →

Section II

Student Number

25 marks

Attempt ALL parts of Question 33 Genetics-The Code is Broken?

Allow about 45 minutes for this part

Questions continue on next page →

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

Question 33 Genetics – The Code is Broken? (25 marks)

(a) Compare the inheritance of a multiple allele trait with a trait that follows Mendelian inheritance. (2 marks)

(b) Outline the history of the selective breeding of an agricultural species and explain the purpose of the selective breeding of this species. (4 marks)

(c) Compare the processes and products of gene cloning with whole organism cloning. (6 marks)

(d) Describe the role of gene cascades in determining limb formation in birds and mammals. (2 marks)

(e) (i) Name a disease that may be treated by gene therapy. (1 mark)

(ii) Describe how gene therapy may be used to treat the disease you named in (i). (2 marks)

(f) (i) Give one example of a mutation that is a result of chromosomal rearrangements (not a change in chromosomal number). (1 mark)

(ii) Describe how this mutation may occur. (1 mark)

(iii) Name one genetic mutation that affects human health. (1 mark)

(iv) Describe the effect of the genetic mutation you gave in (iii) on human health. (1 mark)

Questions continue on next page →

(g) A heterozygous red-bodied, long-winged insect (RrLl) is crossed with a white-bodied, short-winged fruit fly (rrll). Numbers of F_1 offspring produced are displayed in the table.

F_1 offspring phenotype	number of offspring
heterozygous red-bodied, short-winged	75
white-bodied, heterozygous long-winged	77
heterozygous red-bodied, heterozygous long-winged	493
white-bodied, short-winged	500

(i) State the name of this type of cross, which was designed to show the relative positions of genes along a particular chromosome. (1 mark)

(ii) Explain how the outcomes of the cross indicate the two genes involved are linked. (2 marks)

(iii) Describe how these results may be used to calculate the map distance between the two genes. (1 mark)

End of Trial paper