James Ruse Agricultural High School

2006

HIGHER SCHOOL CERTIFICATE

TRIAL EXAMINATION

BIOLOGY

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*

Total marks - 100

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 - 30
- 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. The rare trait ocular albinism (almost complete absence of eye pigment) is a sex-linked recessive trait. A man with ocular albinism marries a woman who is a carrier of this condition. What would be the phenotypic proportions of the offspring?

   (A) All their children of both sexes will have ocular albinism.

   (B) About 50% of their daughters will have ocular albinism and 50% of their sons will have ocular albinism.

   (C) About 50% of their daughters will have ocular albinism and all of their sons will have ocular albinism.

   (D) About 50% of their sons will have ocular albinism and all of their daughters will have ocular albinism.

2. What will be the cause if an animal begins to excrete large quantities of urine containing high concentrations of sodium?

   (A) insufficient amounts of aldosterone

   (B) excessive amounts of anti-diuretic hormone

   (C) excessive amounts of aldosterone

   (D) very hot weather

3. What is the name of the scientist who is credited with studying traits that have genes located on the X chromosome?

   (A) George Beadle

   (B) Reg Punnett

   (C) Gregor Mendel

   (D) Thomas Morgan

4. Coat colours of the Shorthorn breed of cattle are an example of a trait determined by codominant alleles. Red, roan (a mixture of red and white) and white are the three phenotypes in Shorthorn cattle. When roan Shorthorns are crossed amongst themselves, what percentage of the F_1 will be white?

(A) 0%

(B) 25%

(C) 50%

(D) 75%

5. Which option best represents a scientific approach to investigating the influence of altering the temperature on the activity of an enzyme?

	Dependent variable(s)	Independent variable(s)	Control(s)
(A)	rate of reaction	temperature of reaction	pH, substrate concentration, enzyme concentration
(B)	temperature of reaction	rate of reaction	pH, substrate concentration, enzyme concentration
(C)	rate of reaction	pH, substrate concentration, enzyme concentration	temperature of reaction
(D)	substrate concentration, enzyme concentration	pH, temperature	rate of reaction

6. What is the main form of lipid transportation in mammalian blood?

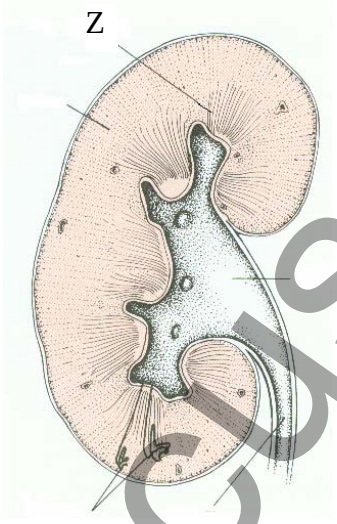
(A) white blood cells

(B) chylomicrons

(C) dissolved in plasma

(D) attached to haemoglobin

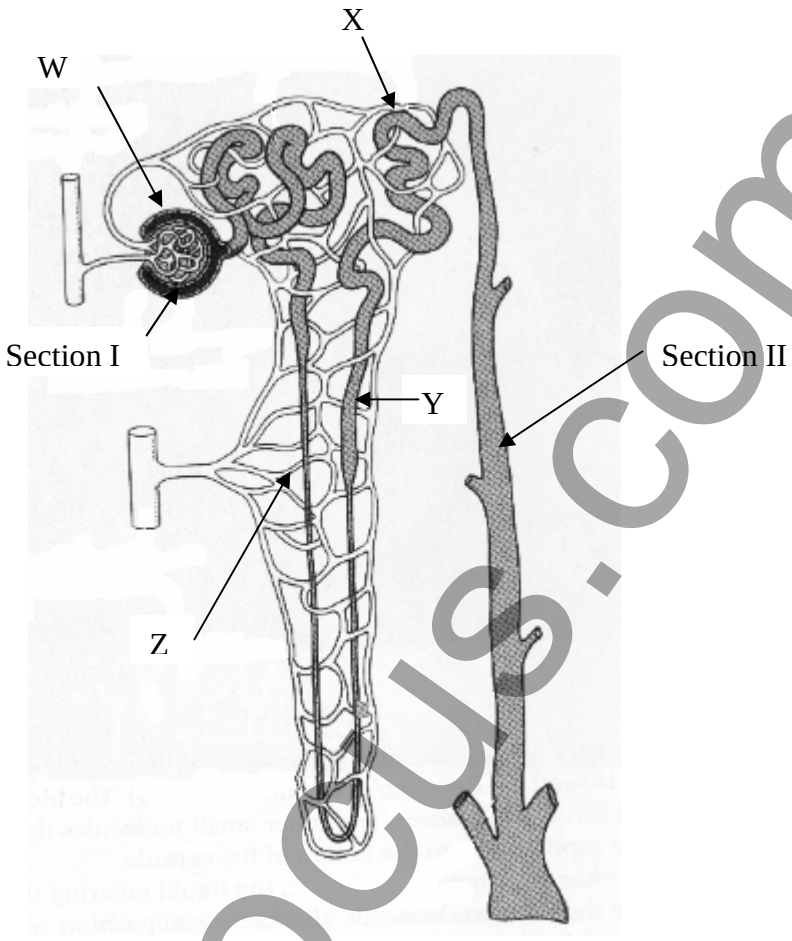
7. The diagram represents a cross-section of a mammalian kidney.



What is the name and function of the kidney section labelled "Z"?

	name of "Z"	function of "Z"
(A)	cortex	contains the loop of Henle and collecting ducts of nephrons
(B)	medulla	contains the loop of Henle and collecting ducts of nephrons
(C)	cortex	contains the Bowman's capsule and loop of Henle of nephrons
(D)	medulla	contains the proximal and distal convoluted tubules

Questions 8 and 9 refer to the diagram of a mammalian nephron.



8. In which segment(s) does the reabsorption of chemicals from the nephron via active transport occur?

(A) W

(B) X

(C) Z

(D) W and Y

9. What is the composition of fluid in sections I and II?

	composition of fluid in section I	composition of fluid in section II
(A)	water, sodium, chloride, glucose, urea, potassium	water, sodium, chloride, urea, potassium
(B)	water, sodium, chloride, glucose, urea, potassium, proteins	water, sodium, chloride, glucose, urea, potassium
(C)	water, sodium, chloride, glucose, potassium, red blood cells	water, sodium, chloride, glucose, potassium
(D)	sodium, chloride, glucose, urea, potassium	water, sodium, chloride, glucose, urea, potassium, proteins

10. A single-strand segment of DNA is CATGACTCG. What would be the complementary DNA strand?

(A) CATGACTCG

(B) GUACUGAGC

(C) CAUGACUCG

(D) GTACTGAGC

11. What are the forms of the main metabolic wastes from reptiles?

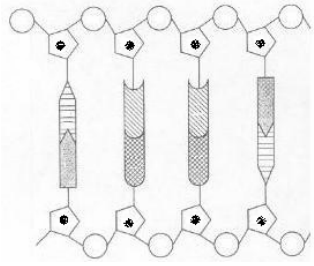
(A) carbon dioxide and urea

(B) carbon dioxide and ammonia

(C) oxygen and urine

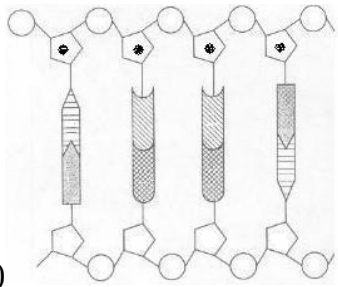
(D) carbon dioxide and uric acid

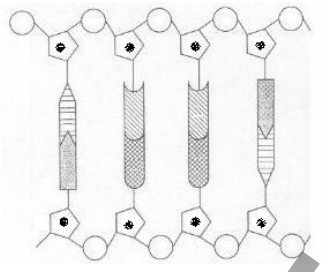
12. The diagram depicts a DNA molecule.

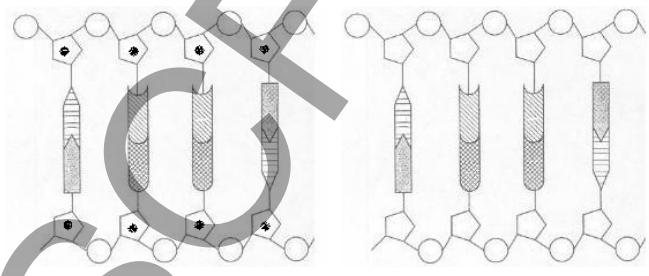


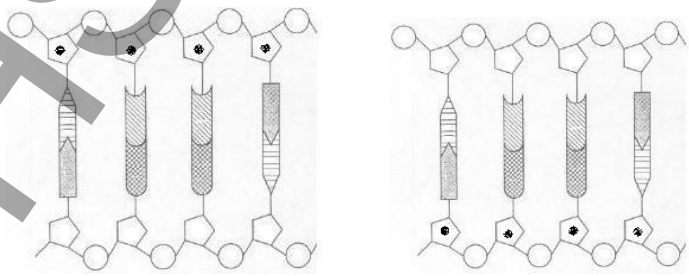
Note: the black dot represents the insertion of a radioactive atom.

Which diagram shows the results after replication of the DNA molecule?

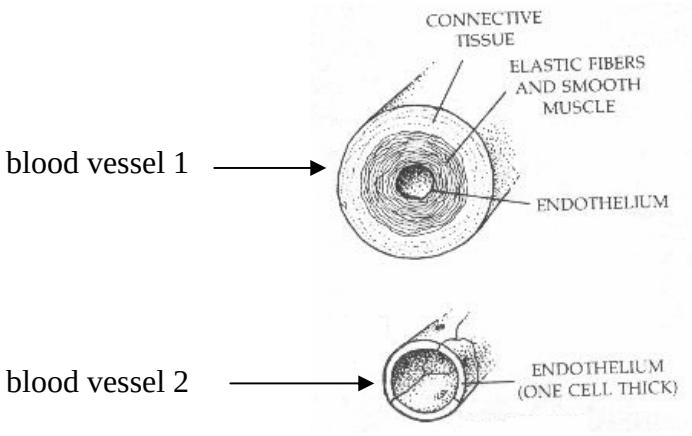
(A) 

(B) 

(C) 

(D) 

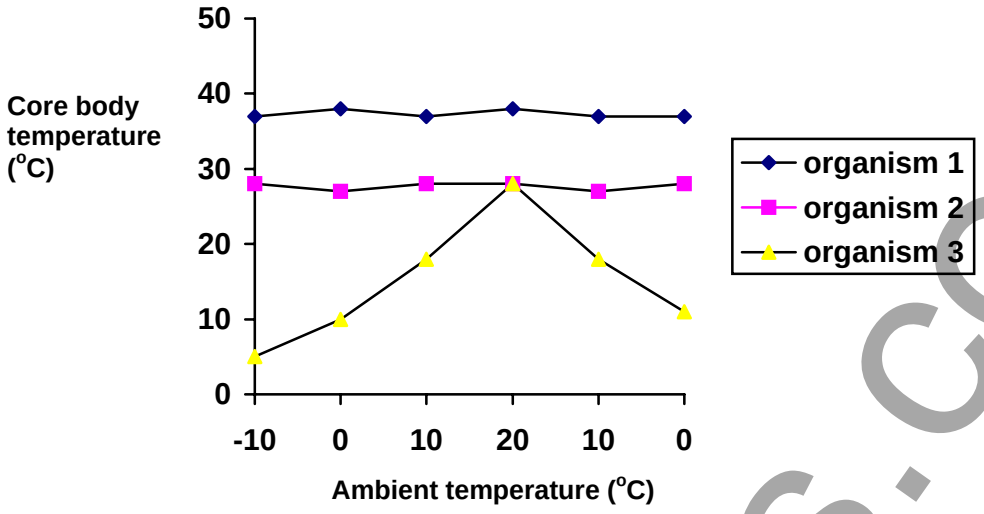
13. The diagram shows two types of blood vessels found in mammals.



What are the names of the blood vessels represented in the diagrams?

	Blood vessel 1	Blood vessel 2
(A)	vein	artery
(B)	artery	capillary
(C)	artery	vein
(D)	capillary	vein

14. The graph shows the core (internal) temperature range of several organisms as a result of the ambient temperature each encounters in their habitat.



Which organism(s) would be classified as an endotherm?

(A) organism 1 only

(B) organism 3 only

(C) organisms 1 and 2

(D) organisms 2 and 3

15. What processes are involved in the transport of materials within a blood dialysis machine?

(A) active transport across a semi-permeable membrane

(B) diffusion across a semi-permeable membrane

(C) active transport across a membrane

(D) diffusion and active transport

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 (4 marks)

"Current reproductive technologies and genetic engineering have the potential to alter the path of evolution."

Discuss this statements.

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Questions continue on next page →

Question 17 (3 marks)

After learning about the nitrogenous wastes excreted by various organisms, a group of biology students hypothesised that the excretion products of pigeons when mixed with water destroyed the microbes that were present in the water.

Describe the experimental method that you would employ to prove that the excretion products of pigeons when mixed with water destroyed the microbes that were present in the water.

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Questions continue on next page →

Question 18 (3 marks)

Describe three different methods for treating water in order to reduce the risk of infection from organisms such as *Giardia* and *Cryptosporidium*.

Questions continue on next page →

Question 19 (4 marks)

(a) State the name of one infectious disease. (1 mark)

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(b) State the name of one non-infectious disease. (1 mark)

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(c) Compare infectious diseases with non-infectious diseases. (2 marks)

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Questions continue on next page →

Question 20 (3 marks)

Using an example, describe how the theory of evolution is supported by palaeontological evidence.

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Questions continue on next page →

Question 21 (4 marks)

Assess the impact advances in technology have made on our understanding of evolutionary relationships.

Questions continue on next page →

Question 22 (2 marks)

State the name of one mutagen and describe evidence for the mutagenic nature of this mutagen.

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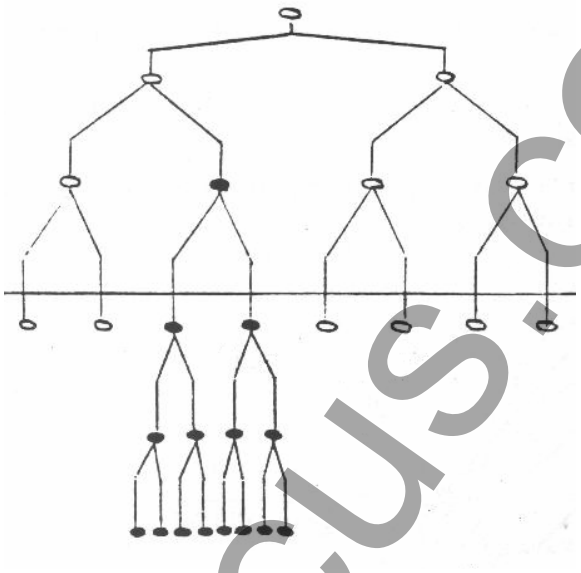
Questions continue on next page →

Question 23 (9 marks)

The diagram shows what happens over a period of time after one type of *E. coli* cell (white-coloured) is placed in a normal environment. *E. coli* is a bacterium. After some time the normal environment is changed by adding a chemical, streptomycin, a common antibiotic.

normal environment →

changed environment →
(streptomycin added)



(a) State the name of the cell division process by which the bacterium replicates in both types of environments. (1 mark)

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Questions continue on next page →

(b) Explain the appearance of the black-coloured bacterial *E. coli* strain in the normal environment. (2 marks)

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(c) Compare the effects of the two environments on the bacterium *E. coli*. (3 marks)

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Questions continue on next page →

(d) Explain how these results support Darwin and Wallace's theory of evolution. (3 marks)

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(e) Is the diagram representative of Darwin's theory of gradual evolutionary processes or does it represent punctuated equilibrium evolutionary processes? Explain your answer. (2 marks)

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Questions continue on next page →

Question 24 (3 marks)

(a) Using the symbols provided in the key, construct a pedigree for the inheritance of left-handedness in the Jones family described.

Left-handedness in the Jones family

Mrs Jones is a right-handed female married to Mr Jones, a left-handed male. They have three children, a male (Jack) who is right-handed, a male (Mark) who is right-handed and a female (Jill) who is also right-handed. Jack marries a right-handed female and they have two right-handed female children and one left-handed male. Jill marries a right-handed male and they have three children, two males and a female. Two of the males are left-handed; the female is right-handed.

Key

 left-handed male

 right-handed male

 left-handed female

 right-handed female

(b) State the type of genetic inheritance for left-handedness in the family. (1 mark)

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Questions continue on next page →

Question 25 (4 marks)

(a) Compare artificial blood with normal blood in terms of the adaptive advantage of the substances used to transport oxygen. (2 marks)

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(b) Justify why research is being conducted on artificial blood. (2 marks)

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Questions continue on next page →

Question 26 (5 marks)

(a) Draw labelled, longitudinal sections to distinguish between the mature phloem and xylem tissues of plants. (2 marks)

(b) State the name of one theory that accounts for the movement of water in the xylem tissue of plants. Describe this theory. (3 marks)

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Questions continue on next page →

Question 27 (3 marks)

(a) Describe the pH results you obtained when investigating the effect of adding carbon dioxide to water. (1 mark)

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(b) Carbon dioxide affects the pH of water. Explain the implications this effect has for the transportation of carbon dioxide in human blood. (2 marks)

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Questions continue on next page →

Question 28 (3 marks)

Describe one method used to produce a transgenic animal.

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Questions continue on next page →

Question 29 (3 marks)

Compare the processes used by marine fish with those used by freshwater fish in regulating water balance.

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Questions continue on next page →

Question 30 (7 marks)

Two important regulatory processes used by a variety of organisms are homeostasis and enantiostasis. Compare the features of these two regulatory processes using appropriate examples.

Questions continue on next page →

Student Number

Section II

25 marks

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

Allow about 45 minutes for this part

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

Questions continue on next page →

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

(a) Using well-labelled diagrams outline one mechanism responsible for the control of gene expression in eucaryotes. (5 marks)

(b) Describe how scientists can verify that an animal produced is a clone. (2 marks)

(c) Assess the impact of transposable genetic elements on the evolution of bacteria. (3 marks)

(d) Discuss the roles of gene cascades, gene homologues and the timing of gene expression in the development of mammal embryos. (6 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. (1 mark)

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

Questions continue on next page →

(g) A heterozygous grey-bodied, normal winged fruit fly (BbNn) is crossed with a black-bodied, curved-winged fruit fly (bbnn). Numbers of F_1 offspring produced are displayed in the table.

F_1 offspring phenotype	number of offspring
heterozygous grey-bodied, curved winged	43
black-bodied, heterozygous normal winged	45
heterozygous grey-bodied, heterozygous normal winged	560
black-bodied, curved winged	558

(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