James Ruse Agricultural High School

2010

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 – 20 marks
- Attempt Questions 1- 20
- Allow about 35 minutes for this part

Part B – 55 marks
- Attempt Questions 21 - 32
- Allow about 1 hour and 40 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 – 20 marks

Attempt Questions 1 – 20

Allow about 35 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. Which of the following are appropriate Australian plant responses to hot and cold temperatures experienced during daytime?

	Cold (< 5^oC)	Hot temperatures (> 30^oC)
(A)	transpiration decreases	closes stomates
(B)	drops leaves	opens stomates
(C)	small, thick leaves	thick, waxy cuticle
(D)	leaves hang vertically	leaves have maximum exposure to sun

2. What were two experimental techniques used by Gregor Mendel in his study of heredity?

   (A) He used pure-breeding lines. He allowed the pea plants to self-pollinate.

   (B) He studied many characteristics during a cross. He performed many crosses.

   (C) He mathematically analysed the results. He used only heterozygous traits.

   (D) He pollinated the pea plants. He studied at most two characteristics during a cross.

3. What are the differences between viruses and prions?

   (A) Only viruses are pathogens.

   (B) Prions contain RNA; viruses contain DNA.

   (C) Prions consist of protein only.

   (D) Only viruses infect cells.

4. The responses of three Australian organisms to changes in the environmental temperature are given in the table.

Organism	Response to cold temperatures ($< 5^oC$)	Response to hot temperatures ($> 30^oC$)
W	shivering	sweating
X	basking in sun	moving to shade
Y	vasoconstriction of skin blood vessels	vasodilation of skin blood vessels

What type of organism would W, X and Y be most likely to be classified as?

	W	X	Y
(A)	ectotherm	endotherm	endotherm
(B)	endotherm	ectotherm	endotherm
(C)	ectotherm	endotherm	ectotherm
(D)	endotherm	endotherm	ectotherm

5. Coat colour inheritance in certain cats is sex-linked and codominant. Male cats can have yellow or black coat colours. Female cats may be yellow, black or tortoiseshell in colour.

What would be the probability of having yellow female offspring if a tortoiseshell female is crossed with a yellow male?

(A) 0%

(B) 25%

(C) 50%

(D) 75%

6. A cattle farm contained 50 cattle with symptoms of bovine tuberculosis. Tests revealed that each of the diseased cattle was infected with the same type of bacterium.

What would be the next two steps in accordance with Koch's postulates?

	Step 2	Step 3
(A)	Identify the bacterium.	Infect a healthy host with a sample bacterium and look for symptoms.
(B)	check for the presence of the bacterium in healthy cattle.	The bacterium must be isolated from diseased cattle and grown in pure culture.
(C)	Infect a healthy host with a sample bacterium and look for symptoms.	Isolate the suspect microbe from the second host, grow it in pure culture and identify it.
(D)	The bacterium must be isolated from diseased cattle and grown in pure culture.	Infect a healthy host with a sample from the pure culture and look for symptoms.

7. Which substance is transported in the form of a chylomicron in mammalian blood?

(A) Amino acids

(B) Carbohydrates

(C) Digested lipids

(D) Salts

8. How do fossils that represent transitional forms support the theory of evolution?

(A) They show the features of two species of organisms.

(B) They show the features of two different groups of organisms.

(C) They show the features of two related species of organisms.

(D) They show the features of a unique, extinct organism.

9. Which technology would be appropriate for the non-invasive measurement of oxygen saturation in blood during anaesthesia?

(A) Arterial blood gas analysis

(B) Capnometer

(C) Data logger

(D) Pulse oximeter

10. Which set of chemicals is required to synthesise part of a polypeptide?

(A) DNA, protein, ribosome, amino acids

(B) enzyme, mRNA, tRNA, amino acids

(C) mRNA, ribosome, tRNA, amino acids

(D) ribosome, tRNA, amino acids

11. Which option correctly describes the effects of anti-diuretic hormone when released in the kidney?

	location of hormone action in nephron	effect on water concentration in blood	effect on salt concentration in blood
(A)	distal tubule and collecting duct	decreases	increases
(B)	distal tubule and collecting duct	increases	decreases
(C)	proximal tubule and collecting duct	decreases	increases
(D)	proximal tubule and collecting duct	increases	decreases

12. What roles do the components of the nervous system play during homeostasis?

	detection	coordination	response
(A)	effectors + nerves	hypothalamus	hormones
(B)	receptors + motor nerves	central nervous system	sensory nerves + effectors
(C)	receptors	hypothalamus	hormones
(D)	receptors + sensory nerves	central nervous system	motor nerves + effectors

13. In the early 1900s three scientists were influential in furthering our understanding of inheritance beyond the work of Mendel. Their work is summarised in the table.

Scientist	The work of each scientist
1	Experimented with fruit flies and concluded that some genes were found on the x chromosome and were sex linked.
2	Experimented with sea urchins and showed that chromosome numbers halved during meiosis.
3	Experimented with grasshoppers and observed the similarity between the behaviour of chromosomes and Mendel's inheritance factors.

What are the names of these scientists?

	Scientist 1	Scientist 2	Scientist 3
(A)	Theodor Boveri	Thomas Morgan	Walter Sutton
(B)	Theodor Boveri	Walter Sutton	Thomas Morgan
(C)	Thomas Morgan	Theodor Boveri	Walter Sutton
(D)	Thomas Morgan	Walter Sutton	Theodor Boveri

14. What type of evidence did Beadle and Tatum's experiment provide for mutants, DNA and genetic activity?

	Evidence 1	Evidence 2
(A)	bread mould can be mutagenic	one gene is responsible for the formation of one enzyme
(B)	chemicals can be mutagenic	one gene is responsible for the formation of one amino acid
(C)	radiation can be mutagenic	one gene is responsible for the formation of one polypeptide
(D)	X-rays can be mutagenic	one gene is responsible for the formation of one protein

15. In his experiment, Louis Pasteur used specially designed flasks and broth. What steps would he need to do in order to make his experiment valid?

(A) Pour equal amounts of broth into two different types of flasks. Boil both flasks for the same time.

(B) Pour equal amounts of broth into two identical flasks. Boil both flasks for the same time.

(C) Pour different amounts of broth into two identical flasks. Observe both flasks for mould growth.

(D) Pour different amounts of broth into two different types of flasks. Observe both flasks for mould growth.

16. Why is the Y chromosome of humans passed on unchanged from one generation to another?

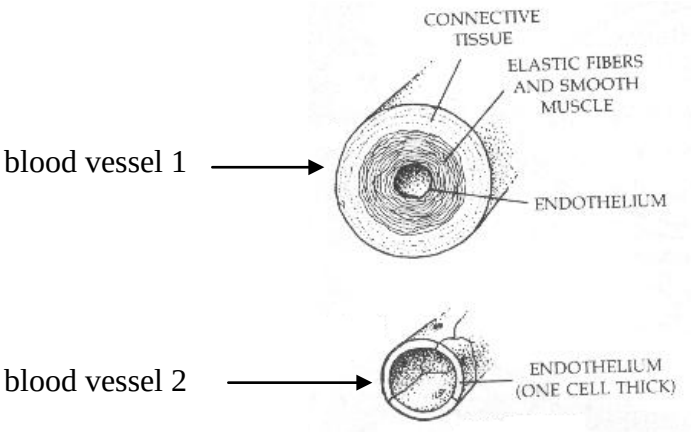
(A) The Y chromosome does not undergo mutation.

(B) The Y chromosome is not involved with meiosis.

(C) The Y chromosome does not undergo crossing over.

(D) The Y chromosome does not segregate randomly.

17. The diagram shows two types of blood vessels found in mammalian kidneys.



What would be the general chemical composition of blood in each type of the blood vessel in the kidney?

	Blood vessel 1	Blood vessel 2
(A)	hydrogen carbonate, salts	oxyhaemoglobin, urea
(B)	hydrogen carbonate, urea	oxyhaemoglobin, salt
(C)	oxyhaemoglobin, salts	hydrogen carbonate, urea
(D)	oxyhaemoglobin, urea, salts	hydrogen carbonate, salts

18. Organisms that are osmoconformers use amino acids, glucose and other small molecules to vary the concentrations in their cells to match their environment. What type of process is this an example of?

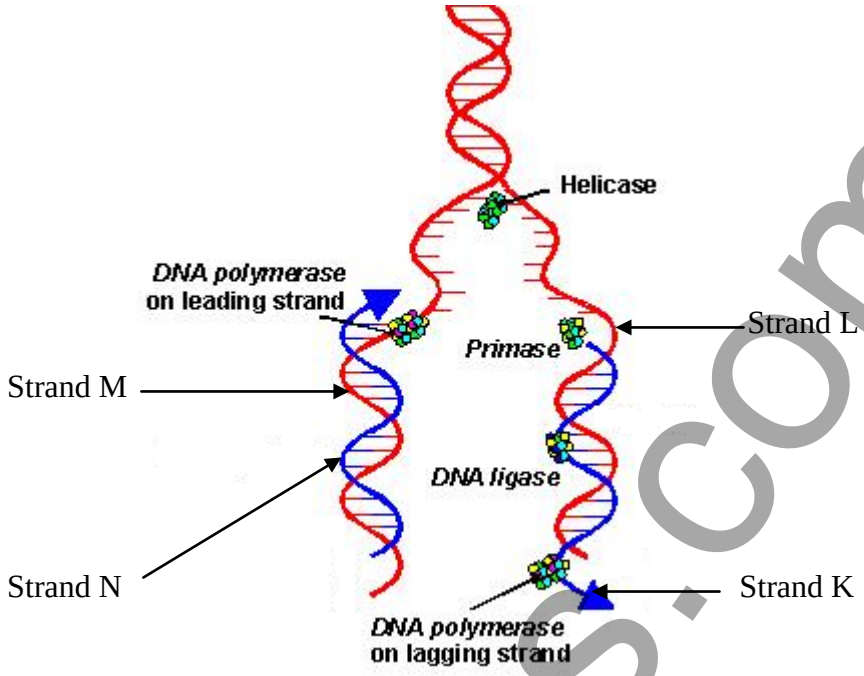
(A) diffusion

(B) enantiostasis

(C) homeostasis

(D) osmosis

19. The diagram shows the process of DNA replication.



Which strands would have the same sequences of nitrogenous bases?

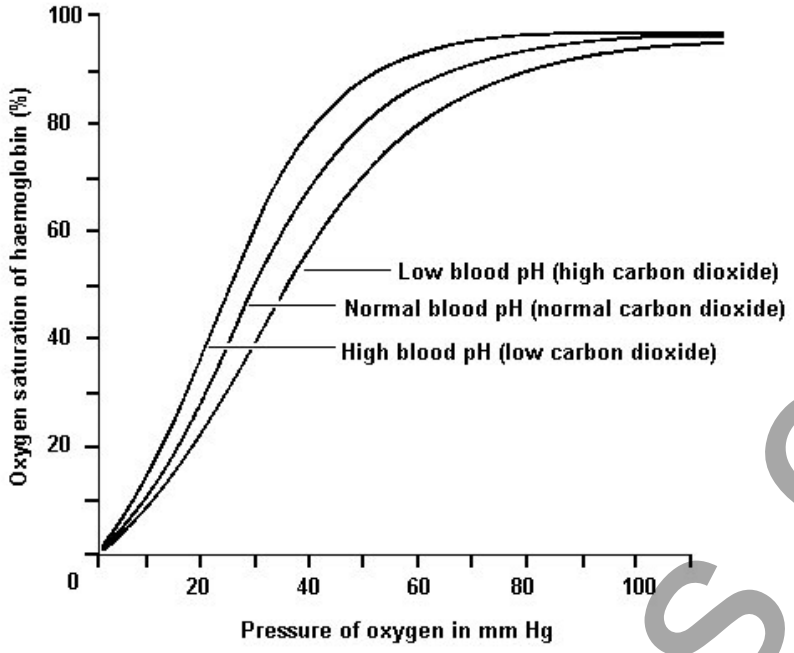
(A) Strand L and strand N

(B) Strand L and strand M

(C) Strand K and strand N

(D) Strand M and strand N

20. The graph shows the oxygen dissociation curves for Hb at various blood pH levels.



What does this data show with respect to the effect of blood pH on the function of haemoglobin?

(A) Blood pH has no effect on the carriage of oxygen by haemoglobin.

(B) Making the blood less acidic results in less carriage of oxygen by haemoglobin.

(C) Making the blood less acidic results in more carriage of oxygen by haemoglobin.

(D) Making the blood more acidic results in more carriage of oxygen by haemoglobin.

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 ○
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12.	A ○	B ○	C ○	D ○
13.	A ○	B ○	C ○	D ○
14.	A ○	B ○	C ○	D ○
15.	A ○	B ○	C ○	D ○
16.	A ○	B ○	C ○	D ○
17.	A ○	B ○	C ○	D ○
18.	A ○	B ○	C ○	D ○
19.	A ○	B ○	C ○	D ○
20.	A ○	B ○	C ○	D ○

Exam Number

Section I (continued)

Part B – 55 marks
Attempt Questions 21 - 32
Allow about 1 hour and 40 minutes for this part

Answer the questions in the spaces provided

Question 21 (3 marks)

The direction of movement of materials transported in the phloem and xylem tissues of plants varies depending on the type of tissue.

State the name of one theory that accounts for the movement of water in the xylem tissue of plants. Describe this theory with the aid of a labelled diagram.

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Question 22 (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 23 (6 marks)

The Bilby inhabits a desert environment, surviving by consuming seeds, plants and insects. Australian insects like the locust also inhabit a desert environment.

Bilby

Australian Locus

(a) Compare the temperature regulatory process of each of these desert-dwelling animals. (2 marks)

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(b) Compare the processes associated with the conservation of water and the production and excretion of nitrogenous wastes excreted by these animals. (4 marks)

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Question 24 (4 marks)

In your course you conducted a first-hand investigation of Australian plant structural adaptations that assist in the conservation of water.

Identify the Australian plant you studied and explain the structural adaptations the plant has that enables it to conserve water.

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Question 25 (2 marks)

Describe the use of hormone replacement therapy in treating people with a deficiency in aldosterone.

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Questions continue on next page →

Question 26 (4 marks)

Kidney failure is treated using a renal dialysis machine.

Outline the similarities and differences between the processes of renal dialysis with the function of the kidney.

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Question 27 (6 marks)

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

(a) Using a case study you have conducted in your course, explain how natural selection contributes towards the evolution of an organism. (3 marks)

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Question 27 *Continued*

(b) Using an example, describe the role that hybridisation within a species may have on evolution. (3 marks)

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Questions continue on next page →

Question 28 (6 marks)

Malaria is an infectious disease that has resulted in the deaths of more humans than any other cause.

(a) Identify the cause of malaria. (1 mark)

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(b) Describe how malaria can be transmitted. (1 mark)

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(c) Describe the major symptoms of malaria. (1 mark)

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(d) Describe two important historical developments that assisted our understanding of the cause and prevention of malaria. (3 marks)

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Questions continue on next page →

Question 29 (2 marks)

Diseases may be caused by a variety of organisms.

(a) Name a disease caused by a macro-parasite. (1 mark)

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(b) Identify the macro-parasite responsible for this disease. (1 mark)

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Question 30 (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 consumption. (2 marks)

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

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Question 31 (7 marks)

Enzymes are considered to be essential components of metabolic functioning in all cells.

(a) With reference to a simple model, explain the effects of substrate concentration on enzyme activity. (3 marks)

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(b) Describe the design of an experiment that you performed in the school laboratory that investigated the effects of substrate concentration on enzyme activity. (4 marks)

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Questions continue on next page →

Question 32 (7 marks)

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

Questions continue on next page →

Section II

Exam Number

25 marks

Attempt ALL parts of Question 33 Genetics-The Code 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 Broken? (25 marks)

(a) Using an appropriate agricultural example, explain the purpose of selective breeding. (3 marks)

(b) A farmer claims that one of his stock is related to a prized pedigree line of the animal.

(i) Describe a method a biologist could use to determine the validity of the farmer's claim. (3 marks)

(ii) Justify your choice of method. (2 marks)

(c) Mutations may have a variety of effects on a species. Compare the effects of chromosomal mutations with gene mutations on the evolution of a species. Use examples to support your answer. (5 marks)

(d) Evaluate the importance of genes and the timing of their expression in the development of embryos. (7 marks)

(e) (i) Give an example of a trait that is determined by multiple alleles in a non-human organism. (1 mark)

(ii) Compare the inheritance of a multiple allele trait with a polygenic trait in terms of genotypes and phenotypes. (4 marks)

End of Trial paper

Question 32 (5 marks)

Marine biologists are concerned that many common fish that inhabit the Great Barrier Reef like the Triggerfish are threatened by global warming. However, the relationship between sea water temperature and fish larval survival rate has only been investigated in a few species.

(a) Write a hypothesis for an experimental investigation concerning the effects of sea water temperature and Triggerfish larval survival rate. (1 mark)

(b) Design an experimental investigation that could be performed to test your hypothesis. (5 marks)

16. What would be examples of appropriate safe work practice when investigating the presence of microbes in food or water using agar plates?

(A) Wear safety glasses and wash hands.

(B) Seal all agar plates and use the pressure cooker to destroy them.

(C) Swab the desks that contained the agar plates with alcohol and leave the lids off the agar plates.

(D) Seal all the agar plates and place them in the nearest bin when finished.