JAMES RUSE AGRICULTURAL HIGH SCHOOL
TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION
2005

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 Student Number at the top of pages 9. 13, 17, 21 and 33**

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 16-27**
- **Allow about 1 hour and 45 minutes for this part**

Section II – 25 marks - Question 28

- **Allow about 45 minutes for this section**

Section I
75 marks

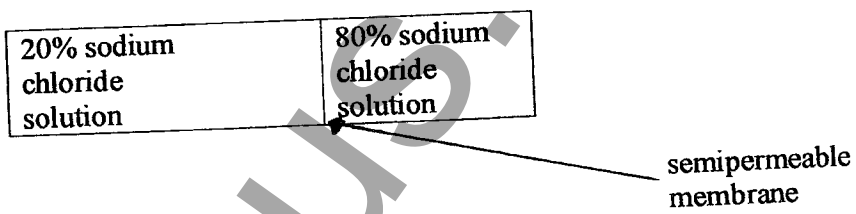
Part A – 15 marks
Attempt Questions 1-15
Allow about 30 minutes for this part

1. Which statement correctly describes white blood cells?

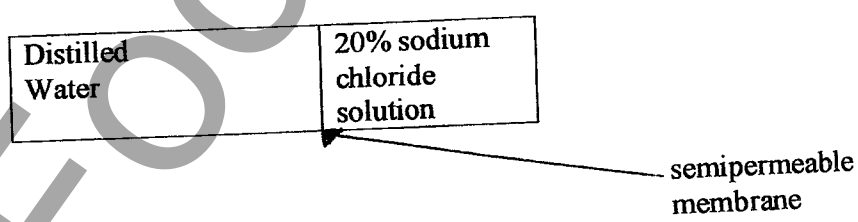
A) smaller than red blood cells but more numerous
B) smaller than red blood cells and fewer in number
C) larger than red blood cells and fewer in number
D) larger than red blood cells and more numerous

2. In which of the diagrams below would you expect water to enter the left hand compartment by osmosis?

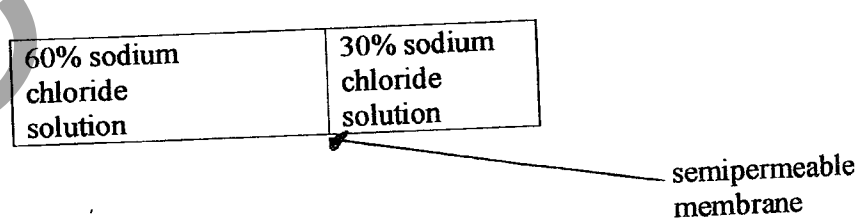
A)



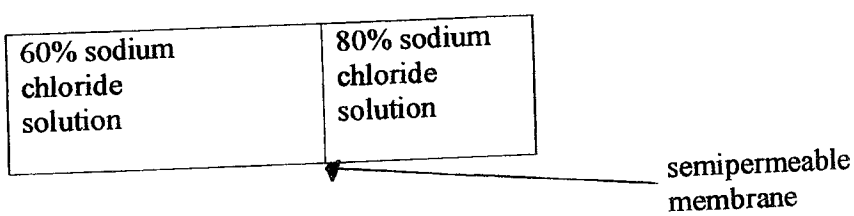
B)



C)



D)



3. Which alternative below most correctly describes the concentration of the listed substance in the blood leaving the kidney compared to its concentration in the blood entering the kidney?

	Urea	Glucose	Amino acids	Water	Drugs and other toxins
A)	Less	Less	More	Less	Less
B)	More	The same	The same	More	Less
C)	Less	The same	The same	Less	Less
D)	More	The same	Less	More	More

4. Which statement below correctly describes movement of materials in the phloem?

A) Organic materials are actively loaded into the phloem sieve tube cell at the 'source' and then move passively along a pressure gradient to the 'sink' cells.
B) Water and mineral ions move from roots to shoots passively
C) Organic material moves passively from roots to shoots in a process called translocation
D) Water and mineral ions move in all directions in the sieve tube cells, using both active and passive transport.

5. Why is the removal of wastes such as urea and carbon dioxide essential?

A) Metabolic reactions cannot take place because the water increases cellular solute concentrations, causing water to move out of cells.
B) Enzyme-controlled processes cannot be carried out properly because a build up of wastes increases cellular solute concentrations and alters other properties such as pH.
C) Enzymes would not function properly because they would combine with the waste molecules instead of substrate molecules.
D) Waste materials are used in respiration, producing too much heat inside cells.

6. Which of the following is the cause of malaria?

A) a fungus
B) a protozoan
C) a virus
D) a macro parasite

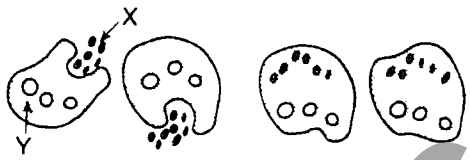
7. Which of the following best describes the process of immunisation?

A) exposing an organism to a pathogen
B) following a healthy lifestyle to promote natural immunity
C) using antibiotics to fight an existing infection
D) stimulating an immune e response by introducing a new pathogen to an organism

8. Which of the following best describes antibodies?

A) components of DNA
B) a foreign body, that is part of a pathogen
C) a type of phagocyte
D) secreted by B cells

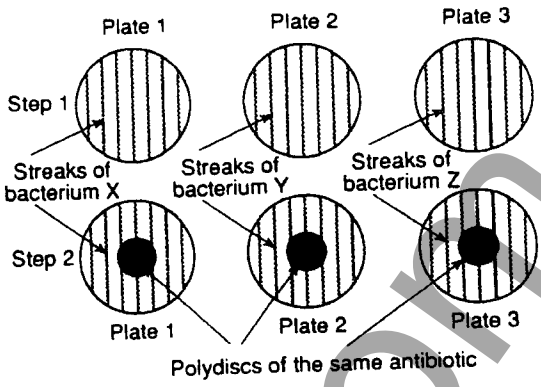
9. The diagram below shows one of our body's defences against disease.



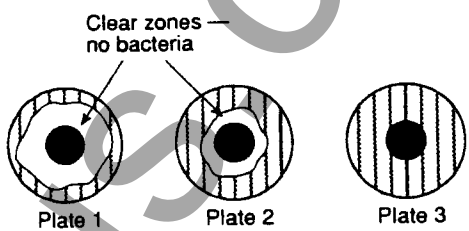
What are the parts of the diagram labelled X and Y?

	X	Y
(A)	T cell	B cell
(B)	antibody	micro organism
(C)	antigen	white blood cell
(D)	micro organism	antigen

10. In an experiment to study the effects of an antibiotic on bacterial growth, agar plates were set up as shown:



The plates were incubated at 37° for forty-eight hours. The diagrams of plates 1, 2 and 3 below show the results.



You could conclude from these results that:

(A) bacteria Z was not effectively controlled by the antibiotic used in the experiment
(B) the antibiotic for plate 1 was different to the antibiotic in plate 3.
(C) the incubation procedures for plate 3 must have been inadequate
(D) when bacteria compete it is likely that only the strongest will survive

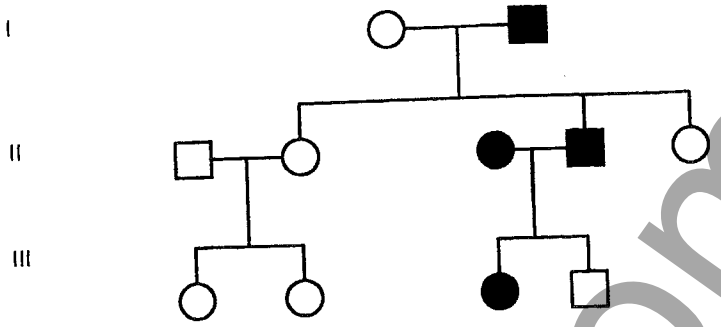
11. Which one of the following is an example of convergent evolution?

A) The different species of finch in the Galapagos islands which have adapted to their own particular environmental niches
B) The Thylacine of Tasmania and the wolf of the Northern hemisphere that are both adapted to a predatory lifestyle
C) The development of DDT resistant insects in farming areas
D) The rapid evolution of new species without the appearance of transitional forms

12. A section of DNA molecule is 30 base pairs long. What is the maximum number of amino acids this would code for?

A) 6 amino acids
B) 15 amino acids
C) 20 amino acids
D) 10 amino acids

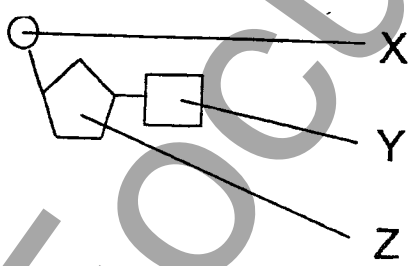
13. The pedigree below shows the inheritance of a certain disease in humans. Affected individuals are shaded.



Which of the following best describes the gene for this disease?

A) non sex-linked and recessive
B) sex-linked and dominant
C) non sex-linked and dominant
D) sex-linked and recessive

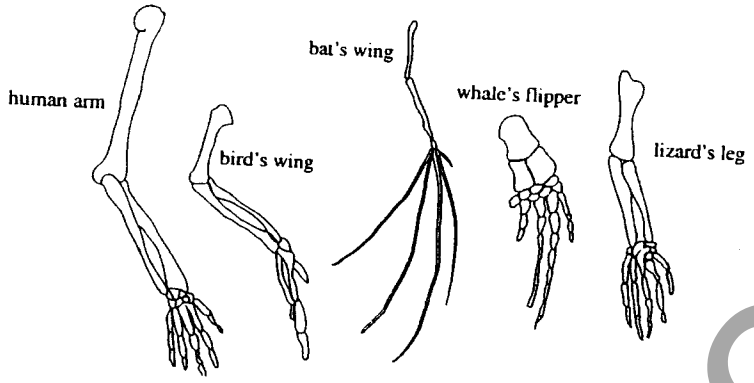
14. Question 14 refers to the following diagram of a section of a DNA molecule.



Which part(s) of the structure above are always the same?

(A) X and Y
(B) X and Z
(C) Y and Z
(D) Y only

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



What form of evidence is shown in the above diagram?

A. homologous structures
B. comparative embryology
C. biochemistry
D. transitional forms

Student Number.....

ANSWER SHEET

Select the alterative that best answers the question. Place a cross in the appropriate space.

SECTION I

PART A – 15 marks

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

Student No.....

SECTION I (continued)

Part B – 60 marks
Attempt Questions 16-27
Allow about 1 hour and 45 minutes for this part

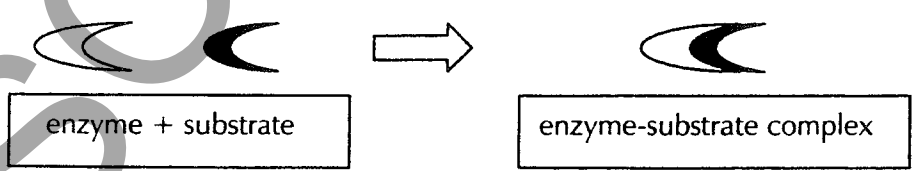
Answer the questions in the spaces provided

Marks

16. **6**

Substance	Form in which it is carried in blood
Carbon dioxide	
Water	
Oxygen	
Mineral salts	
Nitrogenous waste	
Lipids	

17.a) Explain why the following is not an accurate representation of enzyme action. **2**



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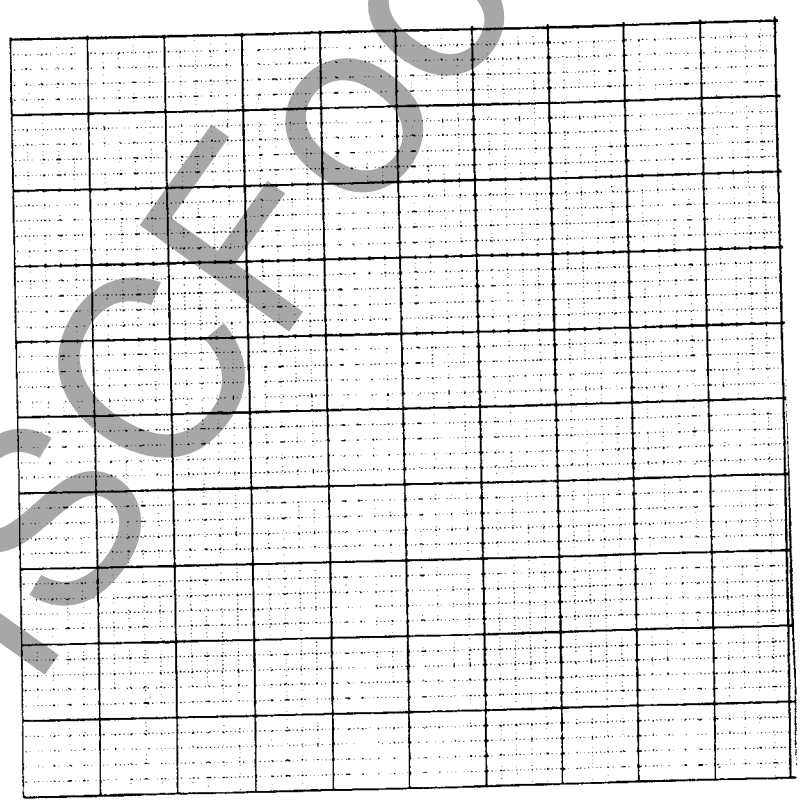
b) Redraw this model to give a better representation of enzyme action (1)

18. The table below shows the activity of two different enzymes at different levels of acidity: **(7 marks)**

pH	Activity of enzyme A (% of maximum)	Activity of enzyme B (% of maximum)
1	0	50
2	30	97
3	70	24
4	90	6
5	95	0
6	60	0
7	0	0
8	0	0

a) On the same set of axes, plot the activity and draw graphs of each enzyme against pH. (3)



b) Describe the relationship between pH and enzyme activity for each enzyme (2)

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c) One of the enzymes above is in fact a stomach protease, and one is the enzyme glucose oxidase (an enzyme used in respiration). Which enzyme, A or B, is the protease? Explain your answer. (1)

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d) Use the terms 'dependent' and 'independent' to describe the variables involved in this investigation. (1)

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4 marks

19. The table below compares the amount of urine produced as a percentage of bodyweight for different mammals and fish.

	Urine output as a	**percentage of**	**bodyweight**
Human	Marine bony fish	Freshwater fish	Kangaroo rat
3%	3%	10%	1.5%

Explain the difference in these figures in terms of the environment of each animal.

3 marks

20. When you performed a first-hand investigation to identify microbes in food or water, describe the risk assessment you carried out, the potential hazards and how they were addressed.

21. Distinguish between a defence barrier and a defence adaptation. Identify one example of each in your answer. **2 marks**

22. **6 marks**

(a) Explain what is meant by the "immune response." **2**

(b) Name a scientist who improved our understanding of the immune response and outline the contribution that was made by this scientist. **2**

(c) Explain why organ transplants should trigger an immune response. **2**

23. Distinguish between: **(9 marks)**

i)a) a prion and a virus **2**

b) a protozoan and a macro parasite **2**

c) a bacterium & a fungus **2**

ii) Name one disease caused by each of these pathogens. Record your answer in a table. **3**

24. **4 marks**

Outline the contribution made by Beadle & Tatum to our current knowledge of genetics.

25. **5 marks**

a) Colour-blindness is a sex-linked trait in humans. If two parents are not colour-blind, but the mother is a carrier for the condition, what is the chance of this couple producing a colour-blind child? Show working. **2**

b) Describe the work of Thomas Morgan that led him to suggest the existence of sex linkage. **3**

26. **4 marks**

Explain the relationship between the structure and behaviour of chromosomes during meiosis and the inheritance of genes.

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27. **7 marks**

You have performed an investigation to construct pedigrees, tracing the inheritance of selected characteristics. From this investigation include:

a) the name of one characteristic you studied **1**

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b) the method you used to study the inheritance of the characteristic **2**

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c) a diagram of a pedigree showing the inheritance of this characteristic including a key 2

d) A conclusion as to whether the characteristic is dominant or recessive 1

e) A discussion of the current use of pedigrees 1

SECTION II Genetics: the code broken

Question 28 (25 marks)

Allow about 45 minutes for this section

Answer the question in a writing booklet

Marks

a) A mother who is Rh^- and with ~~heterozygous~~ blood Group AB and a father who is Rh^+ (whose own father was Rh^-) with ~~heterozygous~~ blood group O produce a number of offspring. Show their possible genotypes and phenotypes and include all working. **4**

b) Distinguish between the terms 'trisomy' and 'polyploidy' **2**

c) Outline the process by which DNA can repair itself. **3**

d) Barbara McClintock's work on corn in the 1940's and 50's led her to propose that genes are transposable. **4**

i) Describe what is meant by this term 'transposable' and how they operate
ii) Discuss their impact on the genome

e) The Human Genome Project is attempting to identify the position of genes on chromosomes. **8**

i) Assess why the Human Genome project could not be achieved by studying linkage maps
ii) Explain how recombinant DNA technology can identify the position of a gene on a chromosome.

f) Distinguish between a germline and a somatic mutation and compare their effect on a species **4**

End of Test