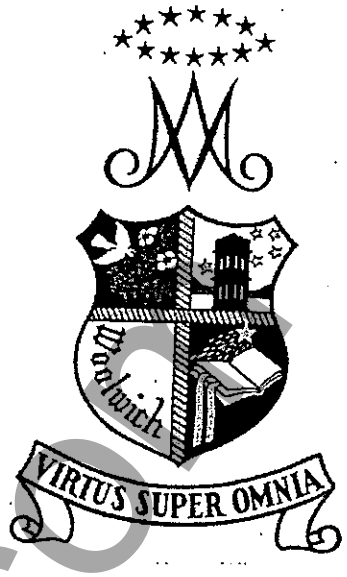


2009

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 student number and/or name at the top of every page

Total marks – 100

Section I – Pages 2 – 18
Total marks (75)
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 16–28
- Allow about 1 hour and 45 minutes for this Part

Section II – Pages 19 – 39
Total marks (25)
Attempt ONE question from Questions 29–33
Allow about 45 minutes for this section

This paper MUST NOT be removed from the examination room

STUDENT NUMBER/NAME: .....

STUDENT NUMBER/NAME: ……..

Section I
Total marks (75)

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

Select the alternative A, B, C or D that best answers the question and indicate your choice with a cross (X) in the appropriate space on the grid below.

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

1. *"thin hair-like projections that beat in a wave-like motion to move pathogens out of the respiratory tract"*

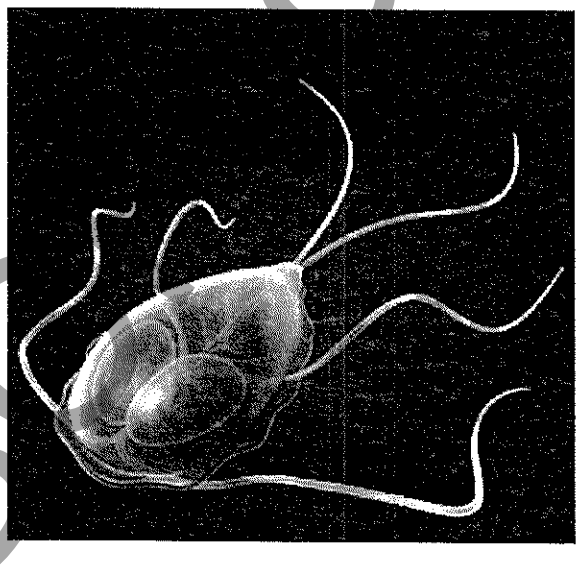
Which of the body's *defence barriers* does this describe?

(A) Skin
(B) Cilia
(C) Mucous membranes
(D) Chemical barriers

2. What would be the immediate effect of an increase in the secretion of *antidiuretic hormone (ADH)* in the bloodstream of a mammal?

(A) Increased levels of potassium ions
(B) Decreased blood pressure and more dilute urine
(C) Decreased levels of sodium ions
(D) Increased blood pressure and more concentrated urine

3. Observe the following image of Giardia.



Giardia is an organism that can cause diarrhoea, bloating, stomach cramps, fatigue and weight loss in humans.

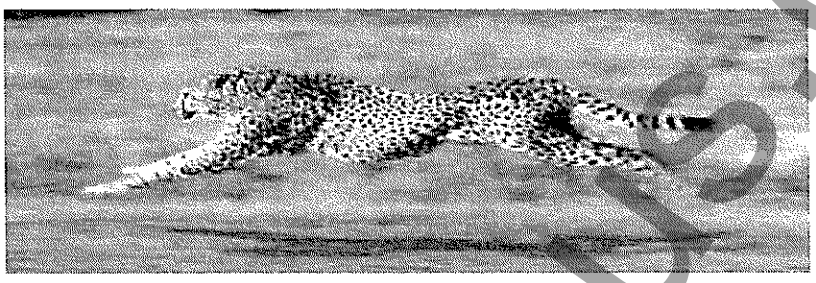
Which word best describes this kind of organism?

(A) Pathogen
(B) Antigen
(C) Prion
(D) Bacteria

4. Which of the following enzymes would work best in the acidic environment of the stomach?

	Enzyme	Optimum pH
(A)	Amylase	6.7-7.5
(B)	Pepsin	1.5-2.0
(C)	Lipase	7-8
(D)	Catalase	9

5. Observe the following image.



Zoos aim to increase populations of endangered species, such as the cheetah, through breeding programs. In these programs, scientists only breed *unrelated* animals.

Why is this important?

(A) Related animals are more likely to fight and injure their young.
(B) Related animals are less likely to mate and produce offspring.
(C) Mating unrelated animals will help to maintain the genetic diversity of the species.
(D) Mating unrelated animals will help scientists to select for favourable characteristics.

6. Why is the removal of carbon dioxide from living organisms important?

(A) Carbon dioxide creates tiny bubbles that damage cell membranes.
(B) Carbon dioxide dissolves in blood plasma to form bicarbonate ions which lower the pH.
(C) Carbon dioxide is a gas which can expand and cause cells to burst.
(D) Carbon dioxide dissolves in the cell cytoplasm to form toxic carbonic acid which damages cells.

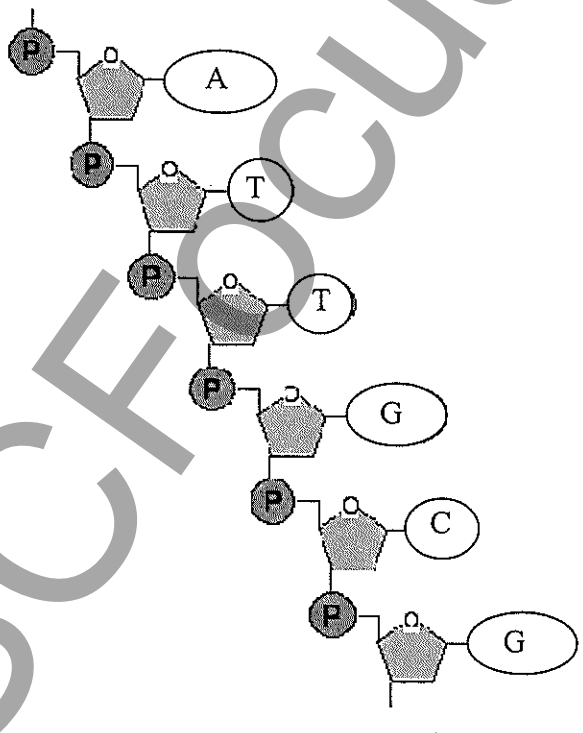
7. The table below represents a monohybrid cross between two pea plants (genotypes Rr and rr). The allele for round (R) is dominant. The allele for wrinkled (r) is recessive.

alleles	**r**	**r**
R		
r		

What is the expected *ratio of phenotypes* in the resulting offspring of this cross?

(A) All wrinkled peas
(B) 3 round :1 wrinkled
(C) 1 round:1 wrinkled
(D) All round peas

8. The diagram below shows a small section from a single strand of DNA.



What would be the *complementary sequence* of nitrogen bases in a strand of m-RNA for this strand?

(A) T-U-U-C-G-C
(B) A-T-T-G-C-G
(C) C-G-G-A-T-A
(D) U-A-A-C-G-C

9. Estuarine organisms, such as marine worms and mussels, must cope with *changes* in the *salt concentrations* of their surroundings from low to high tide. To cope with this, the solute concentration of their body fluids changes with their environment.

Which term describes this process?

(A) Homeostasis
(B) Homozygous
(C) Enantiostasis
(D) Heterozygous

10. Which scientist's work on inheritance in fruit flies led to our understanding of sex-linkage?

(A) Gregor Mendel
(B) James Watson
(C) Rosalind Franklin
(D) Thomas Hunt Morgan

11. Assume a scientist performed the following procedure:

i. Isolated a microbe from an animal suffering from a disease
ii. Cultured the isolated microbe in the laboratory
iii. Introduced the cultured microbe into a healthy animal and observed that it caused the same disease
iv. Isolated a microbe from that animal and observed that it was identical to the original microbe

What may be concluded from this procedure?

(A) The microbe is *not* the cause of the disease as it is non-infectious.
(B) The microbe is the cause of the disease and the disease is infectious.
(C) The microbe had nothing to do with the disease as it was the same type found in the beginning and the end of the procedure.
(D) More tests need to be done as it is difficult to prove only one type of microbe is responsible for causing a disease.

12. Phenylketonuria (PKU) is a genetic disorder that is characterised by an inability of the body to utilise the essential amino acid phenylalanine. If left untreated, severe brain problems occur; such as mental retardation and seizures. This genetic disease can be controlled by diet.

Which category of disease does this description fit?

(A) Inherited disease
(B) Environmental disease
(C) Nutritional disease
(D) Infectious disease

13. Scientists have found that more closely related species have greater similarity in *cytochrome C* amino acid sequences. Comparisons like this allow scientists to observe evolutionary relationships between different organisms.

Cytochrome *c* Evolution

Organism	Number of amino acid differences from humans
Chimpanzee	0
Rhesus monkey	1
Rabbit	9
Cow	10
Pigeon	12
Bullfrog	20
Fruit fly	24
Wheat germ	37
Yeast	42

Using the 'cytochrome C' information, which organism is most closely related to Humans?

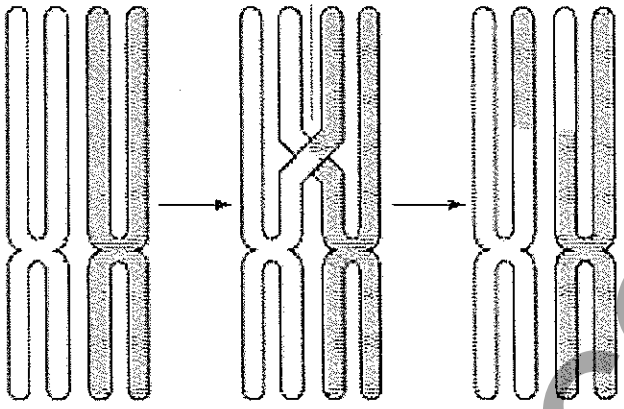
(A) Chimpanzee
(B) Rhesus monkey
(C) Rabbit
(D) Yeast

14. *The first human heart transplant was performed in Cape Town, South Africa, in 1967. The 54-year-old patient survived for just 18 days following the surgery. Today, heart transplant patients can expect to live for many years after heart transplant surgery.*

What is the main reason for this improvement in *survival rate*?

(A) Patients are less likely to die of infection because new and improved antibiotics have been developed.
(B) Surgeons are now better trained and more skilled.
(C) Anti-rejection drugs have been developed to suppress the immune response and thus the donated heart is less likely to be rejected.
(D) Scientists have genetically engineered organs that are less likely to be rejected by the body.

15. Observe the following image.



What process is represented above?

(A) Chromosomes are doubling
(B) Chromosomes are being pulled apart
(C) Independent assortment
(D) Crossing over

Section I (continued)

Part B – 60 marks
Attempt Questions 16–28
Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Question 16 (3 marks) **Marks**

(a) Polar bears (left picture) and brown bears (right picture) are related species but outwardly look quite different. Polar bears are thought to have evolved from brown bears.

Explain how the Darwin/Wallace theory of *natural selection* could account for this example of divergent evolution. **3**

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STUDENT NUMBER/NAME: .....

Question 17 (6 marks) **Marks**

(a) Name ONE Australian *ectotherm* and ONE Australian *endotherm* that you have studied. **2**

Ectotherm: .....

Endotherm: .....

(b) **Complete the table below,** with reference to the examples named in 17 (a). **4**

	Response to increase in environmental temperature	Way in which the response assists in regulating body temperature.
Ectotherm eg:	•	•
Endotherm eg:	•	•

Question 18 (4 marks)

(a) Define the term *active transport*. **1**

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(b) Explain why *diffusion* and *osmosis* are inadequate in removing nitrogenous wastes from organisms. **2**

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Question 18 continues on the next page

Question 18 (continued) **Marks**

(c) Marine animals that inhabit salt water lose water to their surroundings.

Describe a mechanism they use to help maintain water balance. **1**

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Question 19 (4 marks)

During your study of evolution you performed a *first-hand investigation* to model *natural selection*.

(a) Outline the *procedure* used. **1**

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(b) Describe the *results* that were obtained. **1**

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(c) Suggest how *reliability* of the results could be improved. **1**

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(d) Describe ONE *limitation* of the model when using it to explain natural selection. **1**

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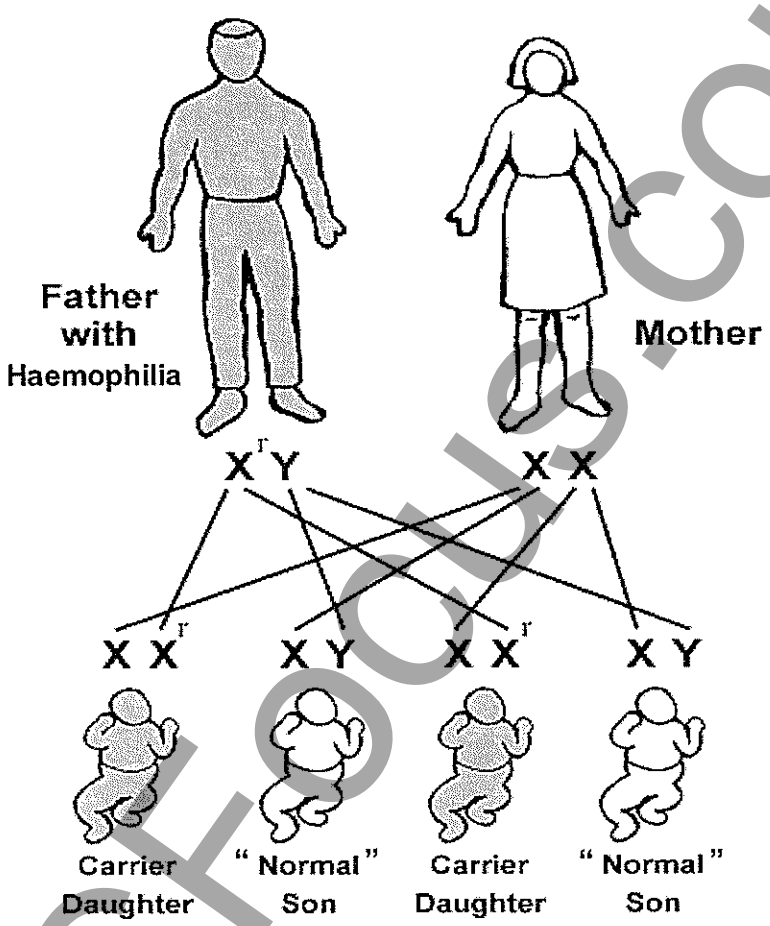
STUDENT NUMBER/NAME: ……..

Question 20 (4 marks) **Marks**

The diagram below illustrates genotypes of offspring when a father with haemophilia has children with a "normal" mother.

Haemophilia is a disease where blood clotting factors are absent, caused by a faulty gene (X^r) carried on the "X" chromosome.



(a) Explain why *all* daughters in the first generation are *carriers* of haemophilia. **1**

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(b) Explain why inheritance of this gene does *not* produce Mendelian ratios. **1**

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Question 20 continues on the next page

Question 20 (continued) **Marks**

(c) In the nineteenth century, most individuals born with haemophilia did *not* survive to reproductive age.

Outline ways in which current environmental factors may affect the expression of this gene in the human population. **2**

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Question 21 (3 marks)

Modern cereal grains, such as wheat and maize, appear different to their ancestral forms.

Explain why humans would *hybridise* crops. **3**

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STUDENT NUMBER/NAME: .....

Question 22 (4 marks)

(a) Explain how ONE of the strategies below has controlled or prevented disease. **2**

- Public health programs
- Pesticides
- Genetic engineering to produce disease-resistant plants and animals.

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(b) Explain why *management* and *prevention* have become more important than *treatment* and *control* of plant and animal diseases. **2**

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Question 23 (5 marks)

(a) Outline the historical experimental evidence that at first led to the Beadle and Tatum to their *one gene: one protein* hypothesis. **2**

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Question 23 continues on the next page

Question 23 (continued) **Marks**

(b) Explain why the *one gene: one protein* hypothesis was later changed to the *one gene: one polypeptide* hypothesis. **1**

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(c) Explain how the results of the experiment performed by Beadle and Tatum can be used as evidence for the *mutagenic* nature of radiation. **2**

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Question 24 (3 marks)

Discuss some of the difficulties in defining the terms *disease* and *health*. **3**

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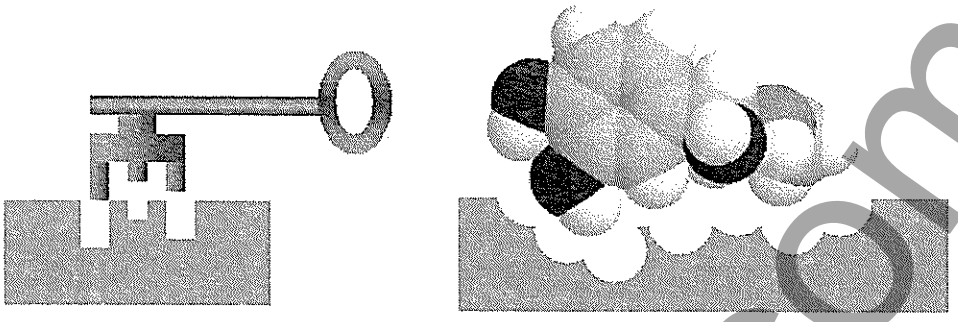
STUDENT NUMBER/NAME: .....

Question 25 (6 marks)

The diagram below illustrates a common model used to explain the *specificity* of *enzymes*.



(a) Identify the model represented by the diagram. **1**

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(b) Explain the role of enzymes in metabolism. **3**

In your answer refer to the *chemical classification* of enzymes.

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(c) Discuss the usefulness of models such as the one shown above to explain biological concepts. **2**

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Question 26 (5 marks)

(a) Identify a disease that can occur in humans from an *imbalance of microflora*. **1**

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(b) List symptoms that this disease produces. **1**

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(c) Identify the *type of pathogen* that causes this disease. **1**

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(d) Identify ONE defence *barrier* that normally prevents the entry of disease AND explain how this protects the body. **2**

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Question 27 (3 marks)

Explain the *adaptive advantage* of *haemoglobin*. **3**

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STUDENT NUMBER/NAME: ……..

Question 28 (10 marks)

(a) Outline the main components of the human body's *immune response*. **6**

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(b) Outline the role of TWO types of *T-lymphocyte*. **4**

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End of Section I

Section II

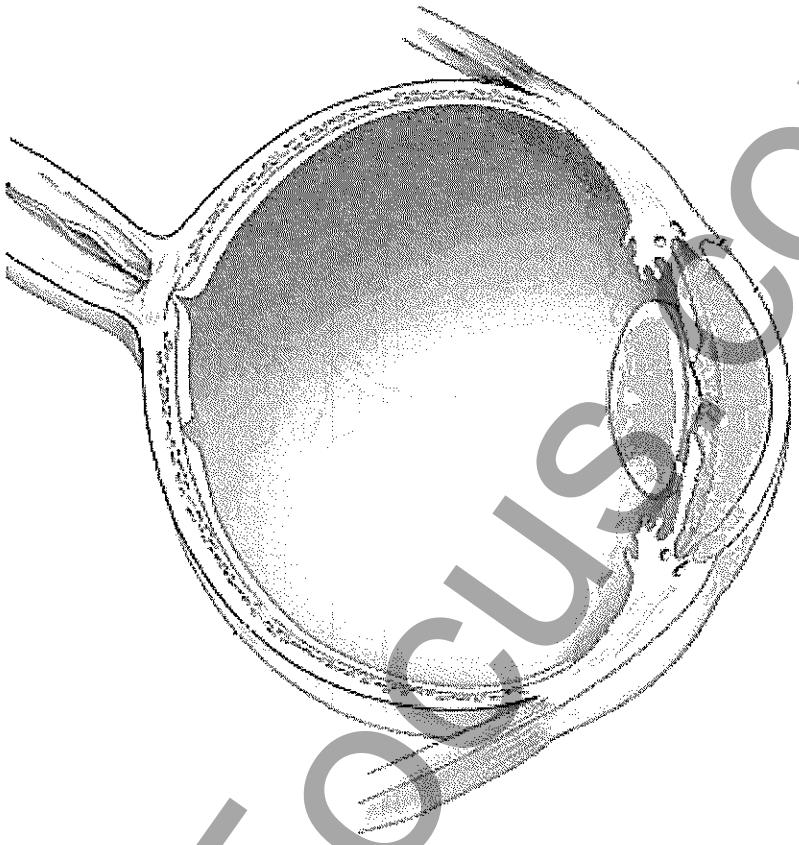
Total marks (25)
Attempt ONE question from Questions 29 - 33
Allow about 45 minutes for this section

Answer the questions in the spaces provided.

STUDENT NUMBER/NAME: .....

Question 29 - Communication (25 marks) **Marks**

(a) (i) On the diagram below label any THREE parts of the eye. **3**



(ii) Describe the *structure* and *function* of ONE part of the eye you labelled in a(i). **3**

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Question 29 continues on the next page

Question 29 (continued) **Marks**

(b) (i) Compare *myopia* and *hyperopia*. Use diagrams to illustrate your answer. **6**

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(ii) Identify how EACH of these conditions in b(i) can be corrected by using technology. **2**

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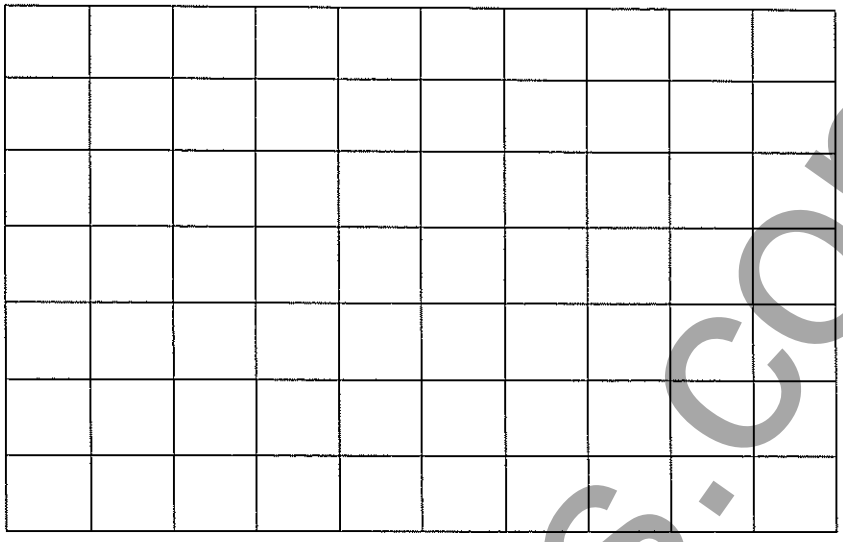
STUDENT NUMBER/NAME: .....

(c) (i) On the grid below, draw a representation of the relationship between *frequency* and *wavelength* of a sound wave. (label axes) **2**



(ii) Identify the relationship between *wavelength* and *pitch* of sound waves. **1**

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(iii) Outline the role of a *sound shadow* cast by the human head in the location of sound. **3**

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Question 29 continues on the next page

Question 29 (continued) **Marks**

(d) Outline the structure AND function of *neurones*. **5**

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End of Question 29

STUDENT NUMBER/NAME: .....

Question 30 - Biotechnology (25 marks) **Marks**

(a) (i) Identify the essentials of *gene manipulation.* **3**

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(ii) Describe ONE of the essentials of gene manipulation identified in (a)(i). **3**

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Question 30 continues on the next page

Question 30 (continued) **Marks**

(b) Evaluate ONE *ethical issue* associated with biotechnology. **5**

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(c) (i) Outline the *differences* between DNA and RNA. **3**

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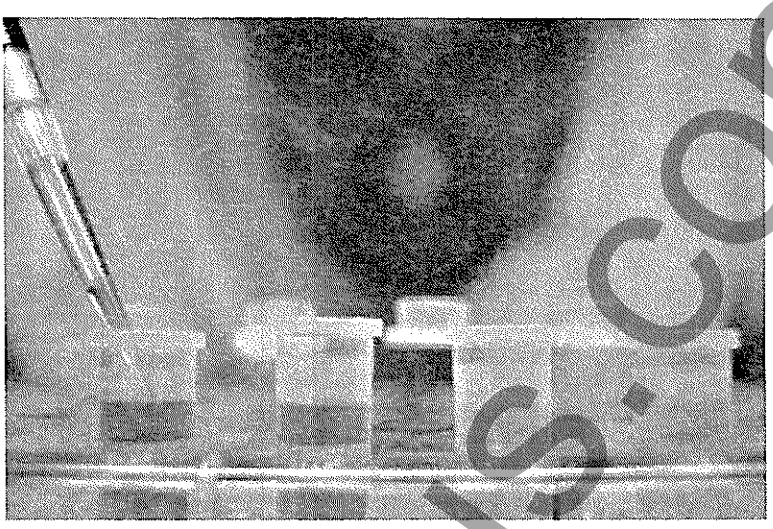
Question 30 continues on the next page

Question 30 (continued) **Marks**

(ii) Observe the following image.



Outline how *forensic scient*ists may use DNA analysis to identify people. **3**

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(d) Identify an ancient *Australian Aboriginal* example of biotechnology. **1**

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Question 30 continues on the next page

Question 30 (continued) **Marks**

(e) Describe the *application* of biotechnology in ONE of the following: **5**

- Medicine
- Animal production systems
- Aquaculture.

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(f) Outline a *fermentation process,* including the type of organism AND the end product. **2**

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End of Question 30

STUDENT NUMBER/NAME: .....

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

(a) Distinguish between *gametic* and *somatic* cells. **2**

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(b) During the course of study, you analysed the difference between *dihybrid* crosses of *linked* and *non-linked* traits.

Discuss your findings. (you may use diagrams to explain your answer) **5**

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Question 31 continues on the next page

Question 31 (continued) **Marks**

(c) Observe the following image.

Explain how the use of *recombinant DNA technology* can identify the position of a *gene* on a chromosome. **4**

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(d) Distinguish between *germ line* and *somatic* mutations. **2**

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Question 31 continues on the next page

Question 31 (continued) **Marks**

(e) Describe the history of *selective breeding* of ONE species for agricultural purposes. **4**

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(f) Describe *gene therapy*.

In your answer refer to a current example of gene therapy. **5**

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Question 31 continues on the next page

Question 31 (continued) **Marks**

(g) Outline the *evidence* that suggests a *common ancestor* of vertebrates. **3**

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End of Question 31

STUDENT NUMBER/NAME: .....

Question 32 – The Human Story (25 marks) **Marks**

(a) Distinguish between *absolute* and *relative* dating techniques.
In your answer, include an example of EACH technique. **3**

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(b) Outline the *general classification hierarchy*. **3**

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Question 32 continues on the next page

Question 32 (continued) **Marks**

(c) Observe the following image.

Discuss recent changes to the *classification of primates*.

In your answer, refer to *advances* in technology that allowed this change. **4**

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Question 32 continues on the next page

STUDENT NUMBER/NAME: .....

Question 32 (continued) **Marks**

(d) (i) **Complete the table below** to compare humans with ONE other primate. **5**

	Human	Other Primate e.g. Orang-utan
Care of young		Young cling to mother for first 2 years
Length of juvenile stage	Approx 12 years	
Development of and size of social groups	Large, complex extended family and social grouping	
The development and use of tools		Basic tools, such as sticks and rocks
Communication system	Complex language and thought	

(ii) Assess the *evolutionary significance* of the similarities AND differences in the table above. **4**

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Question 32 continues on the next page

Question 32 (continued) **Marks**

(e) Discuss how human evolution may be influenced by the following factors: **6**

- Increased population mobility
- Modern medicine
- Genetic engineering.

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End of Question 32

STUDENT NUMBER/NAME: .....

Question 33 – Biochemistry (25 marks) **Marks**

(a) (i) Discuss the importance of *Van Niel's hypothesis.* **3**

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(a) (ii) Outline the part of photosynthesis that is *light-dependent.* **2**

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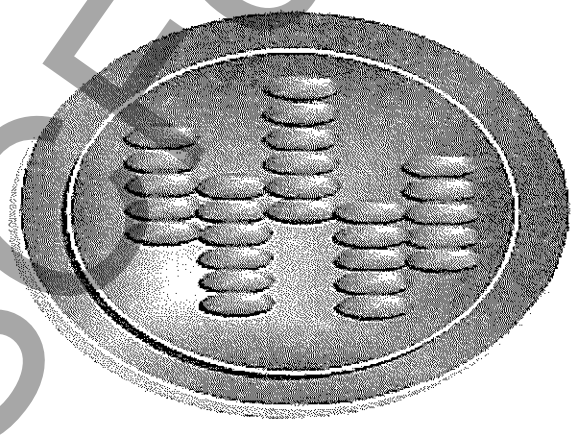
(b) Observe the following image.



Identify the average size of a *chloroplast.* **1**

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Question 33 continues on the next page

Question 33 (continued) **Marks**

(c) Outline *evidence* that confirmed Van Niel's hypothesis. **4**

In you answer, refer to evidence provided by:

- Hill and Scarisbruck
- Ruben.

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(d) Outline the main steps of the *Calvin cycle*. **4**

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Question 33 continues in the next page

STUDENT NUMBER/NAME: .....

Question 33 (continued) **Marks**

(e) (i) Identify a conclusion drawn by *Julius Robert Mayer*. **1**

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(ii) Identify *evidence* that Mayer built upon to form this conclusion. **1**

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(f) Outline the discoveries *of Englemann*, that concern photosynthesis. **4**

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Question 33 continues in the next page

Question 33 (continued) **Marks**

(g) Outline major developments in *microscopy*.

In your answer refer to the significance of EACH development. **5**

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End of paper