

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 – 15

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 16 – 30

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:

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
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1. What does *pH* refer to?

- (A) The preferred heat or temperature of a chemical reaction
- (B) The acidity of a substance
- (C) The solubility of a gas in a liquid
- (D) The reaction rate of an enzyme

2. In pea plants, the allele for tall (**T**) is dominant to the allele for short (**t**).

What would be the expected phenotypic ratio in offspring from a cross between homozygous tall and homozygous short parents?

- (A) All homozygous tall
- (B) All heterozygous tall
- (C) All homozygous short
- (D) Three homozygous tall to one homozygous short

3. What is the function of the hormone *aldosterone* in humans?

- (A) It regulates the transfer of potassium and sodium ions in the kidney.
- (B) It regulates the reabsorption of glucose by active transport in the kidney.
- (C) To reduce water loss from the kidney by constricting kidney tubules
- (D) To increase water loss from the kidney by dilating kidney tubules

4. Which of the following is a non-infectious disease?

- (A) Polio
- (B) Smallpox
- (C) Diphtheria
- (D) Lung cancer


5. *Recently an anti-freeze gene was inserted into salmon DNA in the hope of extending the farming temperature range of the fish. The gene did not produce enough of the protein to extend the salmon's range into colder waters, but it did allow the salmon to continue growing during cold months when non-altered salmon would not grow.*

What do scientists call this technology?

- (A) Transgenic
- (B) Embryo transfer
- (C) Cloning
- (D) IVF

6. *Xenotransplantation* is the use of organs and tissue from animals such as pigs for transplants in human patients. So far this procedure has been unsuccessful.

What is the most likely reason for this lack of success?

- (A) Animal organs such as pig hearts are very different to human hearts.
 - (B) Lack of suitable human recipients
 - (C) Rejection of the organ because of an immune response
 - (D) Surgeons don't have the skills to perform such operations
7. What is the name of the structure represented below?
- 
- (A) Lipid
 - (B) Polysaccharide
 - (C) RNA
 - (D) DNA
8. Which of the following describes *mitosis*?
- (A) Cell division that produces gametes or sex cells
 - (B) Cell division that produces identical daughter cells
 - (C) A process where cells specialise to perform a particular function
 - (D) A spontaneous change in cell DNA
9. How can the study of amino acid sequences be used to support the *theory of evolution*?
- (A) Amino acid sequences do not vary in closely related species.
 - (B) Amino acid sequences show how organisms all evolved from a common ancestor.
 - (C) The more closely related two species are, the greater the difference in their amino acid sequences.
 - (D) It is possible to estimate the relatedness of species by inferring their molecular evolution from the differences in amino acid sequences.

10. How are nitrogenous wastes, such as urea, transported around the body?

- (A) Attached to haemoglobin molecules in blood
- (B) Through lymph vessels
- (C) Dissolved in blood plasma
- (D) Through the digestive system and then eliminated with other wastes

11. What is a mutagen?

- (A) A spontaneous change in DNA that alters protein production
- (B) The offspring of a cloned organism that survives to reproduce
- (C) A nitrogen base found on a DNA strand without a complimentary base
- (D) A natural or man-made substance that can alter DNA structure

12. The steps below are often referred to as Koch's postulates.

- 1 The suspected pathogen must be always associated with the disease.
- 2 ?**
- 3 When a healthy susceptible host is inoculated with the pathogen from pure culture, symptoms of the original disease must develop.
- 4 The same pathogen must be able to be re-isolated from host organisms infected under experimental conditions

Which of the following is the best replacement for step 2 above?

- (A) The suspected pathogen must be able to be isolated from an infected host and grown in pure culture.
- (B) The suspected pathogen must be able to be isolated from an infected host and tested with antibiotics.
- (C) The suspected pathogen must be able to be isolated from an infected host and introduced into a healthy host.
- (D) The suspected pathogen must be able to be isolated from an infected host and observed under a microscope.

13. What is the role of quarantine in Australia?

- (A) To prevent the entry of harmful pests and diseases into Australia
- (B) To prevent the exit of harmful pests and diseases from Australia to other countries
- (C) To patrol Australian waters, preventing illegal fishing of endangered species
- (D) To prevent the importing of domestic pets into Australia

14. How may artificial insemination alter the genetic composition of a population?
- (A) Genetic variability is increased because two unrelated species are crossed.
 - (B) Desirable characteristics may be selected for, thus increasing the genetic variability.
 - (C) Over many generations the genetic variability may be changed.
 - (D) There is a much higher rate of mutation which can damage the genes in a population.
15. What is the purpose of an *epidemiological* study?
- (A) To identify skin cancers on a patient
 - (B) To investigate the cause and effect of a disease
 - (C) To determine the best treatment for a disease
 - (D) To develop new treatments for a disease

Section I (continued)**Part B – 60 marks****Attempt Questions 16–26****Allow about 1 hour and 45 minutes for this part**

Answer the questions in the spaces provided.

Question 16 (3 marks)**Marks**

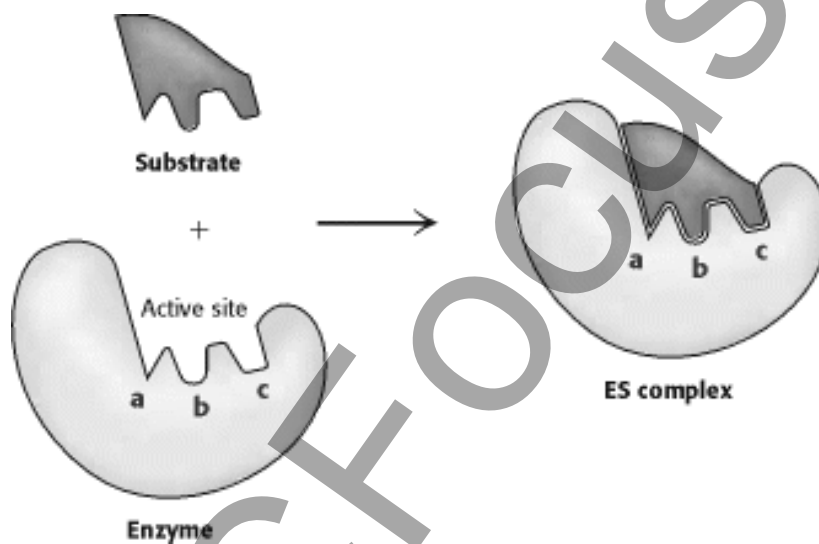
- (a) Define the term
- enzyme*
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- (b) Referring to the diagram below, outline the specificity of enzymes.

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Question 17 (4 marks)**Marks**

- (a) Compare the responses of a NAMED ectotherm and a NAMED endotherm to changes in ambient temperature.

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- (b) Explain how EACH of the above responses may assist in temperature regulation.

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Question 18 (6 marks)

It was observed that in a snapdragon crop of red and white flowers, there were some pink flowers in the next generation.

- (a) Which genetic phenomenon is this an example of?

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- (b) With reference to genetics, explain the occurrence of a pink snapdragon flower.

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- (c) Using the space below, construct a diagram to explain why this kind of inheritance does not produce simple *Mendelian* ratios.

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HSC Focus

Question 19 (3 marks)

Marks

Diabetes mellitus is a disease characterised by abnormal levels of glucose in the blood.

Type 2 diabetes usually begins in later adulthood, develops gradually in most cases and may be present for several years before it is detected.

Type 2 diabetes is treated with weight reduction, a healthy diet and regular exercise. These individuals can still remain relatively healthy for long periods of time.

Discuss the difficulties of defining the terms *health* and *disease*.

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Question 20 (4 marks)

Both *active* and *passive* transport processes occur in the human kidney.

Distinguish between these two processes, using examples to support your answer.

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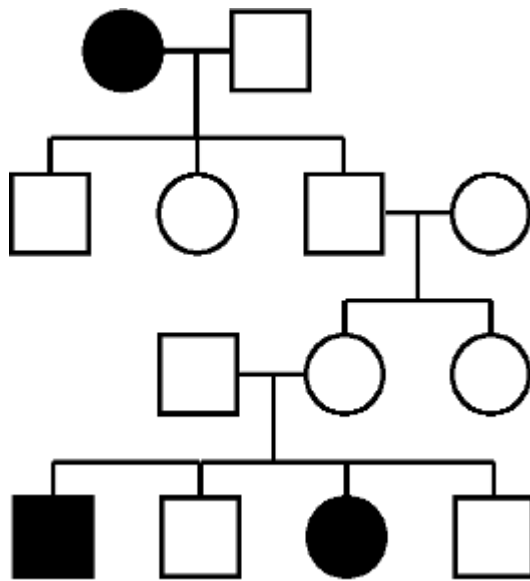
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Question 21 (5 marks)**Marks**

Observe the pedigree below.



- (a) Explain whether the shaded trait is dominant or recessive.

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- (b) Discuss the importance of pedigrees in tracing the inheritance of traits.

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Question 22 (7 marks)**Marks**

In June 2006, the Advisory Committee on Immunisation Practices recommended use of the first vaccine developed to prevent cervical cancer in females, caused by certain types of genital human papilloma viruses. The viruses that cause cervical cancer are spread by sexual contact.

The vaccine, Gardasil®, protects against four HPV types, which together cause 70% of cervical cancers and 90% of genital warts.

- (a) Outline the way that vaccinations prevent infection.

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- (b) Discuss ONE ethical issue arising from a vaccination program such as the one above.

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- (c) Assess the advantages for society of the above immunisation program.

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Question 23 (3 marks)

Marks

Describe the contribution of *Pasteur* to our understanding of infectious diseases.

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Question 24 (5 marks)

(a) Define the term *convergent* evolution.

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(b) Using specific examples, explain how the *Darwin/Wallace* theory of evolution by natural selection accounts for convergent evolution.

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Question 25 (5 marks)

Marks

- (a) Explain why oxygen is needed by living cells.

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- (b) Describe changes in the composition of blood as it moves around the body.

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- (c) Identify the tissues in which these chemical changes occur.

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Question 26 (4 marks)

Describe FOUR different adaptations of Australian native plant species that may reduce water loss.

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Question 27 (3 marks)**Marks**Outline the importance of *Rosalind Franklin* in determining the structure of DNA.**3**

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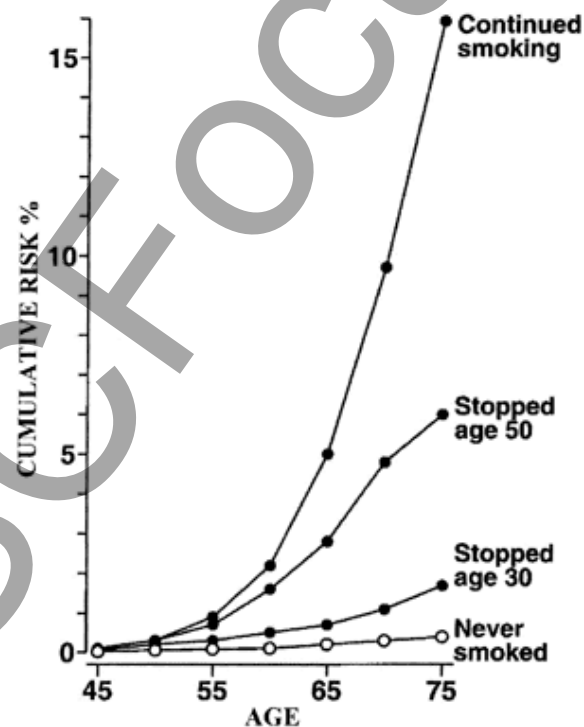
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Question 28 (8 marks)

The graph below shows the relationship between the cumulative risk of lung cancer-related deaths AND smoking habits.



Question 28 continues on the next page

Question 28 (continued)

Marks

- (a) Outline ONE conclusion you could draw from this graph.

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- (b) Outline the *control* in this study.

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- (c) Summarise the benefits to a 30 year-old person who decides to quit smoking.

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- (d) *Epidemiological studies of diseases, such as lung cancer, are often used by governments.*

With reference to the above statement, discuss how this type of study may be useful.

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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 part**

Answer the questions in the spaces provided.

	Pages
Question 29 Communication	17 - 19
Question 30 Biotechnology	20 - 21
Question 31 Genetics: The Code Broken?.....	22 - 24
Question 32 The Human Story	25 - 27
Question 33 Biochemistry	28 - 30

Question 29 - Communication (25 marks)

Marks

- (a) Identify the range of *wavelengths* detected by the human eye.

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[illegible]

- (b) Explain how *depth perception* is possible with binocular vision.

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- (c) Describe the function of *photoreceptor* cells located on the retina of humans.

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HSC

Question 29 continues on the next page

Question 29 (continued)

Marks

(d) Outline the structure and function of TWO of the following:

- Tympanic membrane
- Ear ossicles
- Cochlea
- Auditory nerve

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(e) Identify the function of *neurones*.

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(f) Identify the areas of the *cerebrum* that are responsible for interpretation and perception of sight.

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Question 29 continues on the next page

Question 29 (continued)

Marks

- (g) During your study of 'Communication' you performed a *first-hand* investigation using slides and/or electron micrographs to gather information about the structure of neurones and nerves.

- (i) Describe the method (procedure) you used.

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- (ii) Identify your results.

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- (iii) State and justify your conclusion.

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End of Question 29

Question 30 - Biotechnology (25 marks)

Marks

- (a) Describe the origins of biotechnology.

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- (b) Outline the role of *RNA* in protein synthesis.

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- (c) Describe the main features of the *polymerase chain reaction*.

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Question 30 continues on the next page

Question 30 (continued)

Marks

- (d) Describe ONE example of the application of *aquaculture*.

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- (e) Describe ONE industrial fermentation process.

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- (f) During your study of 'Biotechnology' you performed a *first-hand* investigation to test the conditions that influence the *rate of enzyme activity*.

- (i) Describe the method (procedure) you used.

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- (ii) Identify your results.

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- (iii) State and justify your conclusion.

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End of Question 30

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

Marks

- (a) Define the term *trisomy*.

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- (b) Describe ONE example of *polygenic inheritance*.

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- (c) (i) Describe what is meant by the phrase *transposable genetic element*.

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- (ii) Describe the impact of transposable genetic elements on a genome.

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Question 31 continues on the next page

Question 31 (continued)

Marks

- (d) In the common garden pea plant (*Pisum* genus) studied by Mendel, shape and colour are inherited independently. **R** represents the dominant gene for roundness of shape, while **r** is the recessive wrinkled shape. **Y** represents the dominant yellow pea, and **y** is the recessive green color.

- (i) If a cross between a pea plant of genotype **RRyy** and one of genotype **rrYY** takes place, what would the expected *genotypes* of the offspring be?

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- (ii) If the offspring in (i) were to be crossed with each other, what would be the expected ratio of *phenotypes* for the offspring of this second generation?

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- (e) Outline the main benefits of the *human genome project*.

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Question 31 continues on the next page

Question 31 (continued)

Marks

- (f) During your study of ‘Genetics: The Code Broken?’, you gathered information from *secondary sources* to assess the evidence that analysis of genes allows for a better understanding of evolutionary relationships.

Describe in detail the sources of information you used and the conclusion of your assessment.

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End of Question 31

Question 32 – The Human Story (25 marks)

Marks

- (a) Define the term *species*.

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- (b) Outline the features that classify humans as *primates*.

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- (c) Using an example, explain what is meant by the term *clinal gradation*.

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Question 32 continues on the next page

Question 32 (continued)

Marks

(d) Complete the table below, comparing THREE species of *homonid*.

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	Body structure	Cranial capacity	Fossil ages and probable regional location	Inferred culture
Homo erectus	First human ancestor to walk truly upright. Foramen Magnum moved closer to skull base. Tall, approx. 175-180 cm. 20-30% size difference between males and females	approx. 950-1100cc	70 000 – 1.8 MYA Asia, especially Indonesian	May have used fire, stone tools
Homo neanderthalensis				Buried their dead (often in caves with tools worked objects and flowers), made stone tools
Homo sapiens			130 000yrs old, -mainly Africa	

(e) Describe ONE type of evidence used to compare the relationships between groups of primates.

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Question 32 continues on the next page

Question 32 (continued)

Marks

- (f) During your study of 'The Human Story', you gathered information from *secondary sources* to account for changes in human populations in the last 10 000 years. This information was used to discuss the potential impact of modern technologies on future human populations.

Describe in detail the sources of information you used and any conclusions you might have drawn.

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End of Question 32

Question 33 – Biochemistry (25 marks)

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- (a) Identify *Blackman and Mathgel's* hypothesis.

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- (b) Explain the differences in function of *photosystems* I and II.

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- (c) (i) Identify TWO *isotopes* that have been used to study photosynthesis.

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- (ii) Explain how radioactive isotopes can be incorporated into plants to trace a biochemical pathway.

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Question 33 continues on the next page

Question 33 (continued)

Marks

- (d) *ATP is one of the most biologically important molecules.*

Justify the above statement.

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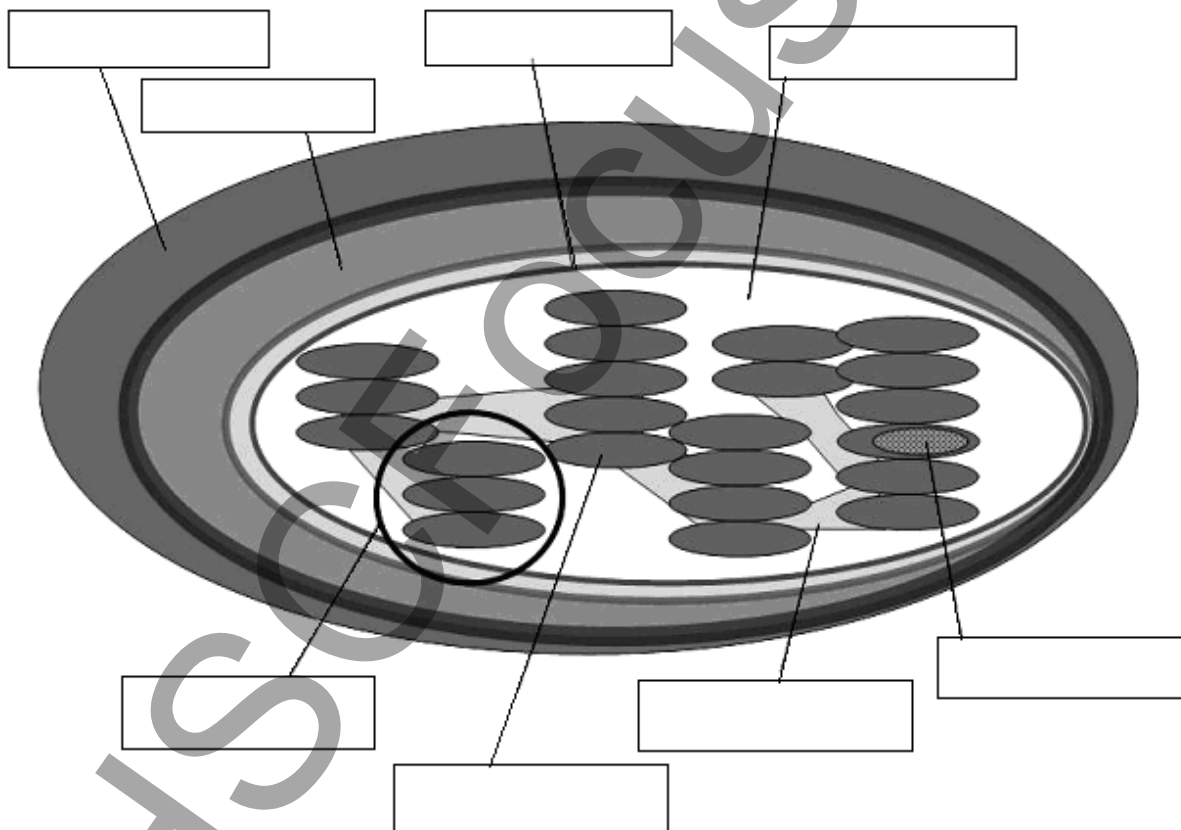
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- (e) Label any FOUR parts of the diagram below, representing a *chloroplast*.

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Question 33 continues in the next page

Question 33 (continued)

Marks

- (f) Describe ONE of the structures labelled in 31(e).

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- (g) During your study of 'Biochemistry' you performed a *first-hand* investigation to determine the effect of light intensity and temperature on gas production in a suitable pond weed.

- (i) Describe the method (procedure) you used.

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- (ii) Identify your results.

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- (iii) State and justify your conclusion.

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End of paper