

MARKER CODE				



STUDENT ENROLMENT NUMBER									

Tonga National Form Seven Certificate

BIOLOGY

2016

QUESTION and ANSWER BOOKLET

Time allowed: 2 hours 15 minutes

INSTRUCTIONS

1. Write your **STUDENT ENROLMENT NUMBER (SEN)** on the top right hand corner of this booklet.
2. Answer ALL QUESTIONS. Write your answers in the spaces provided in this booklet.
3. If you need more space for answers, ask the Supervisor for extra paper. Write your **SEN** on all extra sheets used and clearly number the questions. Attach the extra sheets at the appropriate places in this booklet.

	Pages	Time (mins)	Total
SECTION A Animal Behaviour	2-5	25 mins	17
SECTION B Gene Expression	6-11	55 mins	27
SECTION C Biotechnology Application	12-13	20 mins	10
SECTION D Processes and Patterns of Evolution	14-17	35 mins	21
TOTAL	19	135 mins	75 marks

Check that this booklet contains pages 2-19 in the correct order and that pages 18-19 has been deliberately left blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

SECTION A:**ANIMAL BEHAVIOUR****(17 Marks)****Question 1: Orientation and Navigation**

The picture below shows a the woodlice, *Porcellio scaber*, commonly found in Tonga. The ecological niche of slaters shows they live under rocks where it is damp and moist and are omnivorous, mainly feeding on decaying vegetation, tree bark, rotting wood.



- a. Define “ecological niche”.

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- b. When exposed to the sun, the woodlice relies on innate orientation behaviors to survive.
Define “orientation” in terms of animal behavior.

Skill level 1	
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- c. When the woodlice is put in the sun, it shows both taxis and kinesis orientation. Describe the features of taxes orientation displayed by the woodlice.

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- d. Describe the features of kinesis displayed by the woodlice.

Skill level 2	
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- e. Discuss how kinesis orientation are beneficial for the woodlice when they are exposed to the sunlight.

Skill level 2	
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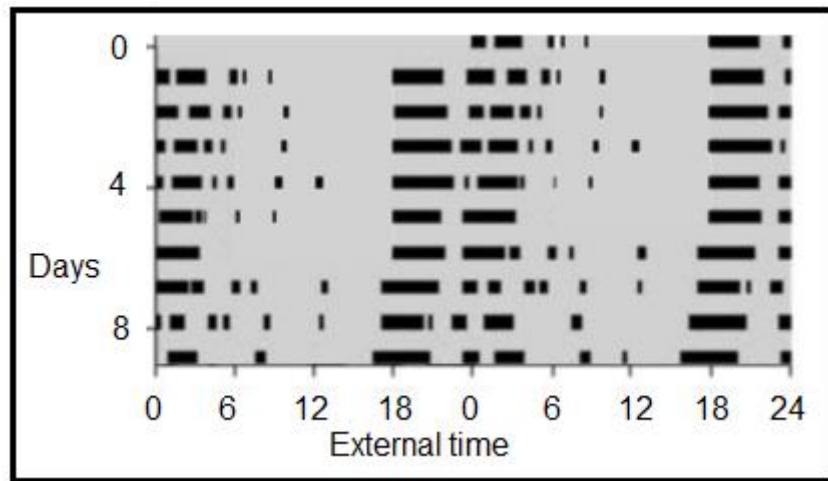
- f. Describe the features of behavioural adaptations that woodlice display in the diagram below.



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Question 2: Timing Responses

The actogram below are a simple type of graph that shows a bat's activity. Bats found in Tonga feed on fruit or nectar.

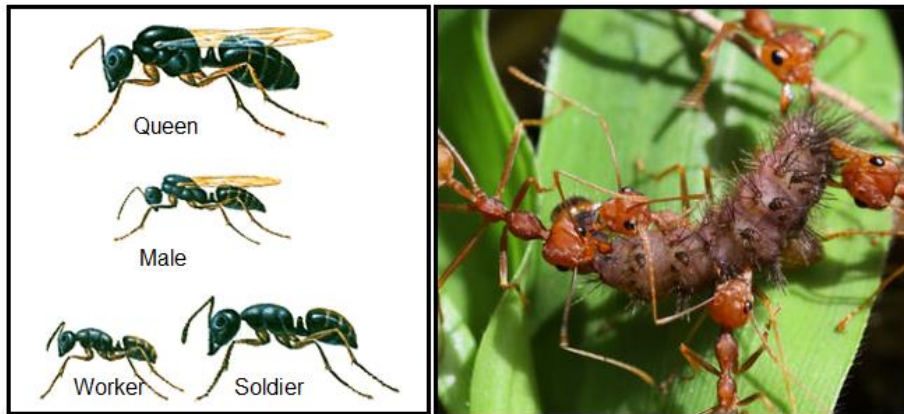


- a. Interpret the fruit bat's activity as illustrated by this actogram graph above.

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Question 3: Intraspecific interactions

Ants are social insects and have complex social structures or colonies. They work together co-operatively, as shown in the picture below:



- a. Explain the advantages and disadvantages of intraspecific interactions in terms of co-operative in ants.

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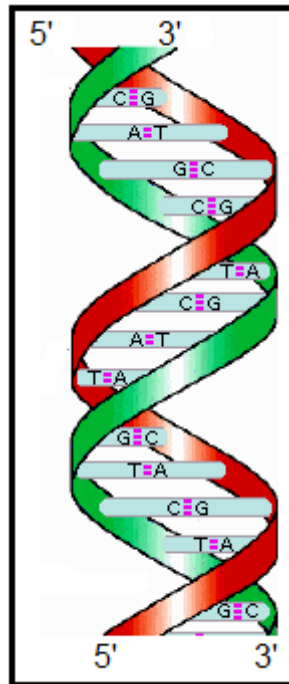
- b. Describe the reproductive strategies of ants.

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SECTION B: GENE EXPRESSION

Question 1: DNA Structure and Replication

a) Describe the structure of a DNA molecule show below: (2)



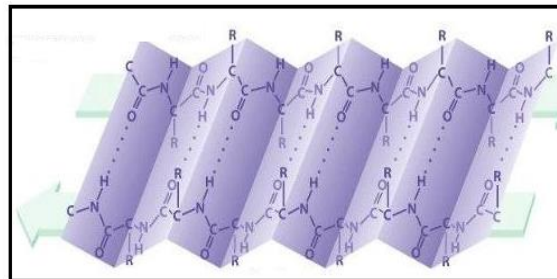
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b) When cells divide, the DNA must be **copied** in a process called DNA **Replication**. Outline this process of DNA replication.

Skill level 3	
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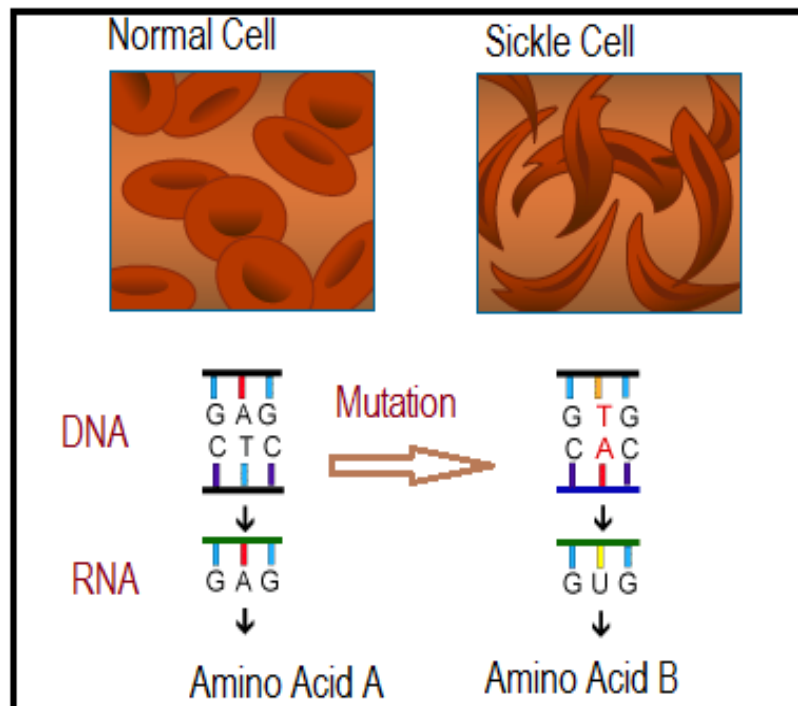
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- This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

b. Proteins are built from a collection of 20 amino acids. The structure of protein depends on its amino acid sequence and chemical bonds between atoms in both the polypeptide backbone and in amino acid side chains.



Question 3: Mutations

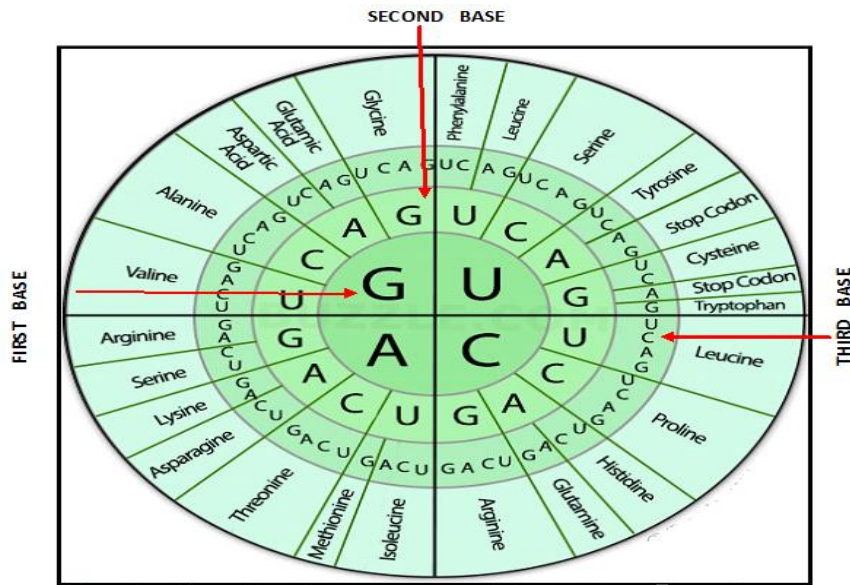
Sickle cell anemia is a genetic disease where one of the genes which codes for haemoglobin undergoes a mutation which results in the mRNA codon being changed from GAG to GUG. The Haemoglobin produced is an unusual type called Hb- which is an inefficient carrier of oxygen. The diagram below shows where this mutation occurs at DNA level.



- a) Describe the features of the genetic mutation shown above that causes sickle cell anemia.

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- b) The chart below lists the various combinations of nucleotides which lead to creation of the 20 known amino acids. Identify the amino acids where the change on mRNA occurred.



Skill level 1	
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- c) The gene for haemoglobin has two co-dominant alleles, Hb^A (the normal gene) and Hb^S (the mutated gene). Explain how co-dominance contributes to variations and survival of the organisms.

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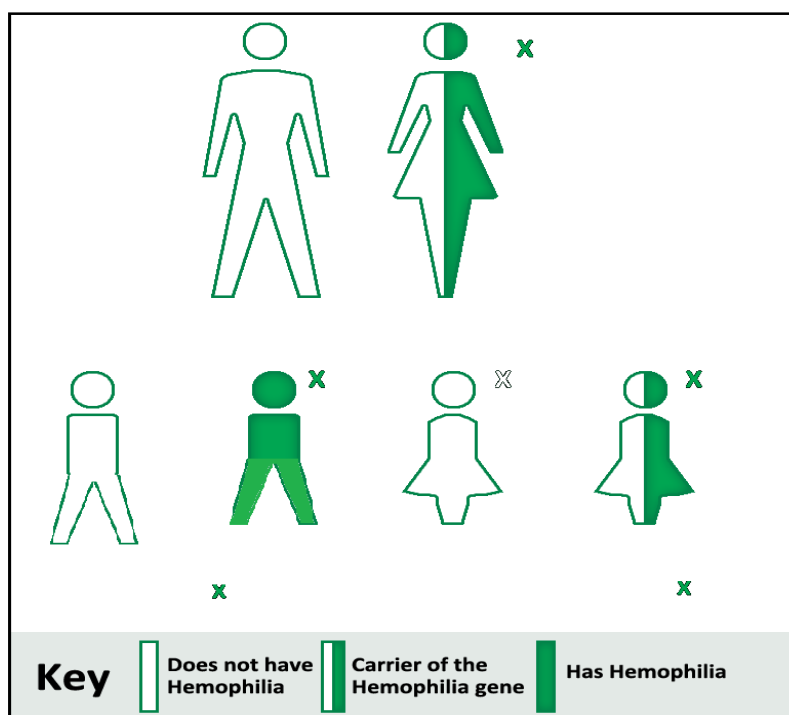
- d) Differentiate between complete dominance, incomplete dominance and co-dominance.

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Question 4: Sex linkage

Sex linkage is the phenotypic expression of an allele that is dependent on the gender of the individual and is directly tied to the sex chromosomes.

- a) Describe the process of inheritance of haemophilia in humans, shown in the diagram below.



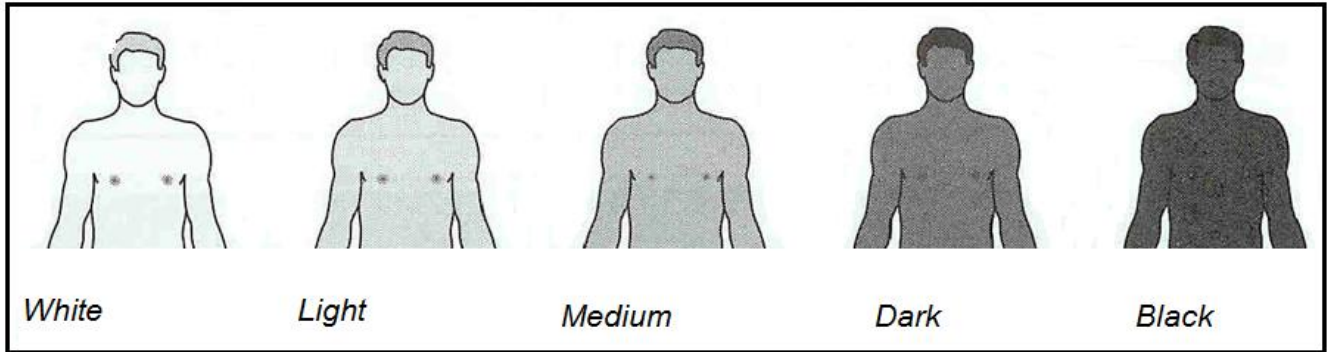
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- b) Differentiate between genotype and phenotype, using the cross above.

Skill level 3	
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Question 5: Gene – gene interaction

Skin colour is an example of polygenic inheritance. Three genes regulate the amount of melanin produced. Each gene has two forms of allele, namely the dark skin allele (A, B, and C) and light skin allele (a, b, and c). Neither allele is completely dominant to the other, and heterozygotes exhibit an intermediate phenotype (incomplete dominance). Each dark skin allele in the genotype adds pigment by increasing melanin production.



- a) Describe the features of polygenes using skin colour in humans as an example.

Skill level 2	
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Dolly was a female domestic sheep and the first mammal cloned from an adult somatic cell, using the process of nuclear transfer. While many mammals and other organisms have been successfully cloned, it is illegal in many countries to clone human tissue.



- [illegible]

Skill level 4	
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Question 2: DNA Profiling

- a) **DNA profiling** (also called DNA fingerprinting, DNA testing, or DNA typing) is a forensic technique used to identify individuals by characteristics of their DNA. Define DNA profiling.

Skill level 1	
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- b) List the techniques of creating DNA profiles.

Skill level 2	
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- c) Describe the process of formation of DNA profiles using these techniques.

Skill level 3	
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SECTION D: PROCESSES AND PATTERNS OF EVOLUTION**Question 1: Variation**

- a) Describe the role of meiosis in producing variation.

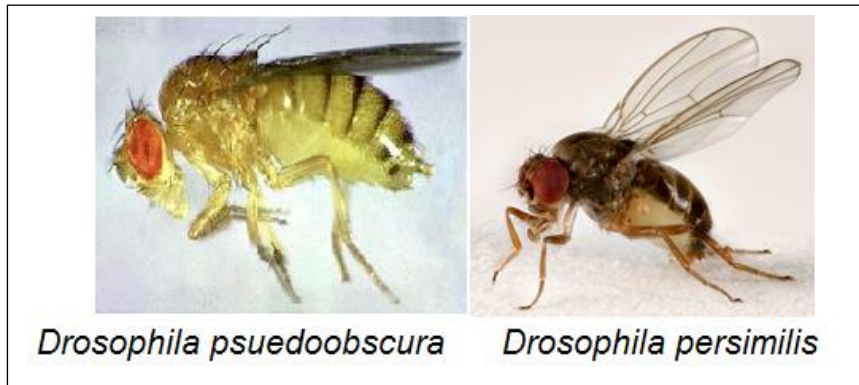
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- b) Discuss the importance of variation in evolution giving specific examples.

Skill level 4	
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Question 2: Speciation

The pictures below show the fruit fly *Drosophila persimilis* which breeds in early morning, while closely related *Drosophila pseudoobscura* breeds in the afternoon.



- a) Identify the type of reproductive isolation mechanism shown by the fruit flies.

Skill level 1	
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- b) Explain the effect of the type of reproduction above on pre-zygotic isolating mechanism.

Skill level 3	
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Question2: Natural Selection

The white Bengal tigers are distinctive due to the color of their fur. A complete scan of the **genome** led to the discovery that the white tiger's distinguishing characteristic arises from a single naturally occurring mutation, which prevent them from producing eumelanin, the pigment required for orange fur.



- a) Define the term “genome”.

Skill level 1	
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- b) For a white Bengal tiger to be born, both parents must carry the unusual gene for white colouring. As this white fur is relatively rare, this has led to a lot of inbreeding in captivity. Explain the impact of this type of selective breeding on white tigers.

Skill level 3	
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Question 3: Patterns of evolution

The pictures below show two different species of mole which are burrowing animals and live most of their life underground but are not closely related.



- a) Identify this type of evolution pattern.

Skill level 1	
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- b) Explain how this pattern of evolution occurred.

Skill level 3	
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- c) Explain how genetic drift influences changes in the population gene pool.

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