TONGA FORM SIX CERTIFICATE
2017
BIOLOGY

QUESTION AND ANSWER BOOKLET

Time allowed: 3 Hours

INSTRUCTIONS:

1. Write your Student Enrolment Number (SEN) on the top right-hand corner of this page.
2. This examination booklet has THREE sections. All sections are compulsory.

<table>
<thead>
<tr>
<th>SECTION</th>
<th>Pages</th>
<th>Total Weight</th>
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</thead>
<tbody>
<tr>
<td>A Multiple Choice</td>
<td>2-7</td>
<td>10</td>
</tr>
<tr>
<td>B Short Answer</td>
<td>8-26</td>
<td>54</td>
</tr>
<tr>
<td>C Extended Response Questions</td>
<td>27-32</td>
<td>15</td>
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<td></td>
<td>35</td>
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3. Additional sheets of paper can be obtained from your supervisor if necessary. Write your Student Enrolment Number (SEN) on each addition sheet and number the questions clearly and insert them in the appropriate part of your booklet.
4. Check that this booklet contains pages 2-35 in the correct order and that page 33-35 has been deliberately left blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR BEFORE YOU LEAVE THE EXAMINATION ROOM
1. **Figure 1** below illustrates an enzyme – catalyzed reaction.

Which concept of ‘enzyme’ is correctly defined by the reaction illustrated in Figure 1?

A. Enzyme active-site  
B. Enzyme specificity  
C. Substrate active site  
D. Substrate specificity

2. Examine table 1 to determine which statement is true about the definition of ‘Photosynthesis’ in green plants?

<table>
<thead>
<tr>
<th>Source of Energy</th>
<th>Converted to</th>
<th>Converted to</th>
</tr>
</thead>
<tbody>
<tr>
<td>A ATP Chemical Energy</td>
<td>Sunlight Energy</td>
<td>Glucose Chemical Energy</td>
</tr>
<tr>
<td>B ATP Chemical Energy</td>
<td>Glucose Chemical Energy</td>
<td>Sunlight Energy</td>
</tr>
<tr>
<td>C Light Energy</td>
<td>ATP Chemical Energy</td>
<td>Glucose Chemical Energy</td>
</tr>
<tr>
<td>D Light Energy</td>
<td>Glucose Chemical Energy</td>
<td>ATP Chemical Energy</td>
</tr>
</tbody>
</table>

**Table 1**

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<tr>
<td>NR</td>
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</tbody>
</table>
3. **Figure 2** shows the movement of water particles across a semi-permeable membrane.

![Figure 2](image)

From your understanding of the concepts of ‘*Transport Processes*’, what process is represented in the diagram above.

A. diffusion  
B. active transport  
C. osmosis  
D. facilitated diffusion

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</tbody>
</table>

4. Which of the following examples belong to the Phylum Mollusca?

<table>
<thead>
<tr>
<th>Examples</th>
<th>Skill level 1</th>
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</thead>
<tbody>
<tr>
<td>A oysters, mussels, squids, octopus</td>
<td>1</td>
</tr>
<tr>
<td>B spiders, millipede, butterfly, centipede</td>
<td>0</td>
</tr>
<tr>
<td>C liver fluke, hookworm, planarian, earthworm</td>
<td>NR</td>
</tr>
<tr>
<td>D Sea urchin, sea stars, starfish, sea gull</td>
<td></td>
</tr>
</tbody>
</table>
5. **Figure 3** shows a pair of chromosome from the same cell.

![Figure 3](image)

What do the lines labelled $P$ point to?

A. the site of alleles made up of two or more genes which are always the same.
B. the site of alleles made up of two or more genes which might be different.
C. the site of genes made up of two or more alleles which are always the same.
D. the site of genes made up of two or more alleles which might be different.

6. In 2000, two different species of mice were set free on an island where they had never lived before. The table shows the “Population Size” changing in the next six years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Mice Population Species 1</th>
<th>Mice Population Species 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>15</td>
<td>15</td>
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<tr>
<td>2001</td>
<td>62</td>
<td>86</td>
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<td>2002</td>
<td>237</td>
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<td>2003</td>
<td>531</td>
<td>105</td>
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<td>2004</td>
<td>926</td>
<td>95</td>
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<td>2005</td>
<td>456</td>
<td>60</td>
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<tr>
<td>2006</td>
<td>629</td>
<td>15</td>
</tr>
</tbody>
</table>
With reference to Gause’s Principle, what can be concluded from this data?

A. Both species are occupying independent habitats
B. Both species are occupying different habitats
C. Both species have similar ecological niches
D. Both species have different ecological niches

7. Dark Phase Reaction (DPR) is part of the Photosynthesis Process.

Figure 4

Which structure (A-D) of Figure 4 would the Dark Phase Reaction specifically occur?

A. A
B. B
C. C
D. D
8. Bats are able to hibernate through winter. Hibernation enable bats to live in a variety of climates, surviving through cold temperatures and limited food supplies in winter.

Which ‘adaptive feature’ do bats show when they hibernate?

A. Structural  
B. Behavioral  
C. Morphological  
D. Physiological

9. Figure 5 outlines a simple show of the digestive tract of a pig.

Figure 5

Which of the following statement defines the process of absorption in the small intestine?

A. Receiving bolus-like food from L and releasing it to J  
B. Receiving of soup-like food from L and releasing it at J  
C. Receiving undigested food from M and releasing it at I  
D. Receiving chyme-like food from L and releasing it to N
10. **Figure 6** shows a kidney tubule and some of its associated blood vessels.

Nitrogenous waste is excreted in which area and in what form?

- A. Excreted in O as Ammonia
- B. Excreted in P as Urine
- C. Excreted in Q as Urea
- D. Excreted in R as Uric Acid

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SECTION B: SHORT ANSWERS

This section consists of **FIVE** questions. **ATTEMPT ALL** questions in the spaces provided.

QUESTION 1

1. **Figure 7** shows part of a cell organelle that plays an important role in the cells of an organism.

![Figure 7]

   Process 1  
   Process 2  
   Process 3

   A  
   B

   Skill level
   2
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   0
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   a. Describe the **features** of the cell organelle shown in Figure 7 that allows it to function well in cells.

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b. Choose **TWO** processes from **Figure 7** to compare and contrast their roles in transporting molecules across cells.

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Skill level 3

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<td>0</td>
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<tr>
<td>NR</td>
<td></td>
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</tbody>
</table>
2. **Figure 8** shows a distribution of four different species of rats in a country.

![Figure 8](image)

Originally, there was only one population of rats in the country.

Explain how **genetic isolation** can result in the development of the four different species.

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<td>NR</td>
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</tbody>
</table>
3. During the last phase of cellular respiration, the following reaction occurs in the matrix of the mitochondria.

**Figure 9**

a. Define cellular respiration.
   
   ________________________________________________________________
   ________________________________________________________________

b. List the products of aerobic respiration.

   ________________________________________________________________


c. Describe what happens at the stage of respiration illustrated in **Figure 9**.

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
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   ________________________________________________________________
QUESTION 2

1. **Figure 11** represents the stages of protein synthesis occurring in a cell.

   ![Figure 11](image)

   a. Name **Organelle A**.

   _______________________________________________________________________

   b. State **TWO** (2) differences between structure **X** and structure **Y**.

   _______________________________________________________________________
   _______________________________________________________________________
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   c. Explain the relationship between structures **X, Y and Z** in protein synthesis.

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   - 0
   - NR

   Skill level 2
   - 2
   - 1
   - 0
   - NR

   Skill level 3
   - 3
   - 2
   - 1
   - 0
   - NR
2. Three babies born at Vaiola Hospital were mixed up at birth. The parents of these babies made enquiries at the hospital about the true identity of the babies they took home.

The table below shows the information taken from the chart of the three babies and their parents.

**BLOOD TYPE OF PARENTAL COUPLES vs INFANTS**

<table>
<thead>
<tr>
<th>Parents</th>
<th>Mother</th>
<th>Father</th>
<th>Infants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parent 1</td>
<td>A</td>
<td>B</td>
<td>BABY X : B</td>
</tr>
<tr>
<td>Parent 2</td>
<td>O</td>
<td>AB</td>
<td>BABY Y : O</td>
</tr>
<tr>
<td>Parent 3</td>
<td>B</td>
<td>O</td>
<td>BABY Z : AB</td>
</tr>
</tbody>
</table>

a) Predict the identity of Baby X, Y and Z by using the information shown above to determine their real parents.

[Use the Punnet Squares on the next page to determine the inheritance of blood types and draw evidences to support your answer.]

Parents for Baby X: ___________________________

Parents for Baby Y: ___________________________

Parents for Baby Z: ___________________________

Evidences:
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
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Skill level 3

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| 1 |
| 0 |
| NR |
Punnet Squares:

Parent 1: _____

Parent 2: _____

Parent 3: _____

or

or

or
1. **Figure 12** shows the relationships between some organisms in an ecosystem.

   a. Describe the interactions of all the organisms in the above ecosystem using the illustrated food web.

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
b. Identify the group of animal that locusts and aphids belong.

______________________________________________________________________

c. Discuss the relationship between biodiversity and survivorship in an ecosystem. (Use examples from Figure 12 to support your discussion.)

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2. Write the terms in the boxes below in the correct order of the taxonomic hierarchy.

   Family   Genus   Phylum   Order   Kingdom   Species   Class

**QUESTION 4**

1. **Figure 13** shows a monocotyledon plant and the sections through its stem and a leaf.

![Figure 13: Plant](image)

Complete the table below to identify structures A, its function and its arrangement in the stems of a monocotyledon plant.

<table>
<thead>
<tr>
<th>Monocotyledon Plant</th>
<th>Structure A</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. Name</td>
<td></td>
</tr>
<tr>
<td>ii. Function</td>
<td></td>
</tr>
<tr>
<td>iii. Arrangement in stems</td>
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<tr>
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</table>
2. **Figure 14** illustrate structures involved in human gas exchange.

**Figure 14**

Describe the differences between the process of **ventilation** and **gas exchange** as shown in **Figure 14**.

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</table>
3. The diagram below shows some of the cell that makes up the components of blood.

Describe the roles of structure X and structure Y in blood circulation.
a. Describe the process occurring at structure D that has led to a successful implantation of the fetus in structure A.
b. Explain the significant role of **structure C** on the successful development of the fetus during the period of pregnancy.
QUESTION 5

1. **Figure 17** below shows gallstones found along the human digestive system.

   **Figure 17**

   a. Define the term **digestion**.

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
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   b. Explain how the presence of gallstones can lead to the malfunction of the human digestive system.

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   **Skill level 1**

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   **Skill level 3**

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2. A form 6 student set up an experiment to observe the role of the stomata and structure X during daytime hours. **Figure 18** illustrates the result of 10 hours of observation.

**Figure 18**

Discuss the observation recorded in **Figure 18** to explain how the size of the stomata relates to the time of the day and its impact on transpiration. You may include in your discussion the following:

i. Significant role of the stomata in Transpiration
ii. Reason for the shape of structure X in the first 8 hours
iii. Reason for change of shape to structure X after 8 hours
3. The osmoregulation process in marine fish results in the excretion of ammonia as nitrogenous waste.

Explain the importance of how osmoregulation functions to release ammonia in marine fish.

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4. **Figure 19** shows a diagram of parts of the human body.

![Figure 19](image)

The liver plays an important role in the process of excretion. Both the liver and the pancreas also play a key role in prevention of diseases.

a. Define the term **excretion**.

________________________________________________________________________
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b. Explain how the liver and pancreas functions to prevent diabetes in human.

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Skill level

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SECTION C: EXTENDED RESPONSE QUESTIONS

This section consists of THREE compulsory questions. You are required to provide an extended response to all questions. Write clearly in the spaces provided for each question. Your discussion should be clear, logical and cohesive.

Some information are provided to help guide your discussion.

QUESTION 1

Application of the process of ANAEROBIC RESPIRATION results in the formation of domestic and commercial products.

Discuss how the process of Anaerobic Respiration can be used to create a commercial product. Use Figure 20 to assist in your discussion.

Figure 20

Your discussion should include the following:

i. Define anaerobic respiration.
ii. Describe the products of anaerobic respiration.
iii. Explain the conditions in plants/animals that causes anaerobic respiration.
iv. Discuss how the processes and conditions causing anaerobic respiration have been applied in the production of a domestic or a commercial product.
QUESTION 2

Figure 21 below illustrates four different types of hibiscus flowers found in Tonga. The phenotype is the effect of mitosis and meiosis cell division in the life cycle of each hibiscus plant.

![Figure 21]

Discuss the general function of mitosis and meiosis in producing the life cycle of hibiscus plants found in Tonga.

Your discussion should include:

i. Definition of mitosis and meiosis

ii. Description of the functions of mitosis and meiosis in plants.

iii. Explain where mitosis and meiosis occurs in flowers and how it relates to its functions.

iv. Comparison of the effects of mitosis and meiosis in the life cycle of the different types of hibiscus plants in Tonga.

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**QUESTION 3**

Choose **ONE** Environmental Issue from the four local environmental problems shown in the diagrams below to answer the question that follows.

![Issue 1: Destruction of mangroves](image1)

![Issue 2: Deforestation](image2)

![Issue 3: Coastal Pollution](image3)

![Issue 4: Flooding of low-lying areas](image4)

Discuss the implications of the issue you chose on the long-term survival of the ecosystem.

**Your discussion should include the following:**

i. Identify the environmental issue.
ii. Describe the environmental issue as experienced locally.
iii. Explain the causes of the environmental issue in your local environment.
iv. Predict the long-term impact of the issue to the survival of the ecosystem with reference to specific characteristic of the ecosystem.
Chosen Environmental Issue: ____________________________________________

_______________________________________________________________________

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Skill level 4

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