TONGA GOVERNMENT
MINISTRY OF EDUCATION AND TRAINING

TONGA SCHOOL CERTIFICATE
2015

BIOLOGY

QUESTION AND ANSWER BOOKLET

Time Allowed: 3 Hours + 10 minutes reading

INSTRUCTIONS

1. This Examination Paper consists of THREE sections. Answer ALL QUESTIONS.

   Section A: Multiple Choice Questions  40 Marks
   Section B: Short Answers Questions    140 Marks
   Section C: Long Answers Questions     20 Marks

2. Write your Student Personal Identification Number (SPIN) where appropriate at the top right hand corner of this page and on the last page.

3. Attempt ALL Questions in the space provided in this Booklet. An answer sheet for SECTION A is provided at the back of this Booklet.

4. Budget your time wisely. Approximately spend 40 minutes for SECTION A, 1½ hour for SECTION B and 50 minutes for SECTION C.

5. You may or may have not studied any of the organisms used as examples in this paper. You are expected to apply the principles, skills and key concepts studied during your Biology course to the question given.

6. Please check that you have pages 2 – 36 in this booklet. Page 33-35 has been deliberately left blank.

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

TOTAL MARKS: 200
SECTION A:  MULTIPLE CHOICE QUESTIONS  (40 marks)

Write the letter of the BEST answer in the Multiple Choice Sheet at the END of this Booklet. Each question is worth 2 marks.

1. What is the ecological definition of the term ‘community’?
   
   A. All the organisms in an area.  
   B. All the food webs in an ecosystem.  
   C. All the individuals of one species in an area.  
   D. The living organisms and their non-living environment.

2. Which of the following organisms is the producer of a food chain?

3. Which of the following list contains only arthropods?
   
   A. Annelids, insects and myriapods.  
   B. Insects, myriapods and arachnids.  
   C. Crustaceans, insects and molluscs.  
   D. Arachnids, crustaceans and myriapods.
4. In the ecosystem of a tropical rainforest, the producers obtain energy from
   A. Sunlight.
   B. consumers.
   C. decomposers.
   D. rotting leaves.

5. Which group could be a single population?
   A. All the birds counted in one day in a garden.
   B. All the animals and plant on an isolated island.
   C. All the bacteria in a colony of Bacillus subtilis.
   D. All the insects occupying three hectares of farmland.

6. The condition that is caused by a deficiency of calcium is ________________.
   A. anemia.
   B. rickets.
   C. osteoporosis.
   D. anorexia nervosa.

7. What waste material is excreted by the kidney?
   A. Fat.
   B. Urea.
   C. Fibre.
   D. Carbon dioxide.

8. The diagram shows a neurone.

   ![Neurone Diagram]

   Which structure could be found at X?
   A. Leg.
   B. Eye.
   C. Brain.
   D. Spinal cord.
9. The graph shows the relationship between the average age at death and the number of cigarettes smoked per day.

Which of the following is a correct conclusion from the graph?

A. Most people living longer than 74 years are smokers.
B. Most people smoking 30 cigarettes a day die from lung cancer.
C. Non-smokers live at least 4.5 years longer than people who smoke.
D. People smoking five cigarettes a day live longer than those smoking 15 cigarettes a day.

10. Where in the female reproductive system would an ovum be fertilized?

A. Ovary.
B. Uterus.
C. Vagina.
D. Fallopian tube.

11. What is the main function of a companion cell in a mature phloem tissue?

A. Provide the source of assimilates for storage.
B. Provide the nucleus for cell division in the phloem.
C. Provide structural support for the sieve tube element.
D. Provide cytoplasmic contact with the sieve tube for loading.
12. The diagram below shows a germinating bean seed.

What structures are X, Y and Z?

A. X is cotyledon, Y is radicle, Z is plumule.
B. X is plumule, Y is cotyledon, Z is radical.
C. X is plumule, Y is radicle, Z is cotyledon.
D. X is radicle, Y is plumule, Z is cotyledon.

13. Which process in green plants produce carbon dioxide?

A. Respiration.
B. Transpiration.
C. Translocation.
D. Photosynthesis.

14. The diagram below shows a potato tuber.

What is being transported in the phloem cells at X?

A. Starch upwards.
B. Sugars upwards.
C. Starch downwards.
D. Sugars downwards.
15. Which statement correctly describes advantages or disadvantages of self-pollination to a plant?

   A. It needs little pollen but there is a high chance of pollination.
   B. It needs no agent to transfer pollen but pollination is unlikely.
   C. It needs a lot of pollen but can happen when a plant is on its own.
   D. It needs two plants of the same species but there is little variation in the offspring.

16. Where are the male gametes produced in a flowering plant?

   A. Petal.
   B. Sepal.
   C. Stigma.
   D. Stamen.

17. What determines the sex of a baby?

   A. The father’s blood group.
   B. The mother’s blood group.
   C. The father’s chromosomes.
   D. The mother’s chromosomes.

18. The diagram shows a plant cell.

   ![Plant Cell Diagram]

   Which labeled part of the cell controls all the chemical reactions inside the cell?

   A. Nucleus.
   B. Vacuole.
   C. Cell wall.
   D. Chloroplast.
19. All human cells formed by meiosis are ________________

A. genetically identical and they become tissues.
B. genetically identical and they become gametes.
C. not genetically identical and they become tissues.
D. not genetically identical and they become gametes.

20. Cell X contains 24 chromosomes. It divides by mitosis to provide cells Y and Z.

How many chromosomes does cell Z contain?

A. 8  
B. 12  
C. 24  
D. 48
SECTION B: SHORT ANSWER QUESTIONS

ANSWER ALL THE QUESTIONS IN THIS SECTION.
Write your Answers in the spaces provided.

Question 1 (20 marks)

1. Figure 1.1 below shows part of the human digestive system.

   ![Diagram of the human digestive system](image)

   a) Label the gall bladder correctly with the letter X.

   b) Label the pancreas correctly with the letter Y.

   c) State TWO functions of the liver in relation to digestion.

      i. _____________________________

      _____________________________

      ii. _____________________________

      _____________________________

   d) Suppose the bile duct is blocked. Explain TWO reasons why this may affect the digestion of fat?

      ____________________________________________

      ____________________________________________
2. Gaseous exchange takes place while air flows in and out of the lungs.

   a) Define gas exchange.

   ________________________________________________________________
   ________________________________________________________________

   b) State THREE ways in which inhaled air is different from exhaled air.

   i. ________________________________________________________________
   ________________________________________________________________

   ii. ______________________________________________________________
   ________________________________________________________________

   iii. ______________________________________________________________
   ________________________________________________________________

   c) Explain how the diaphragm and the intercostals muscle functions to aid inhalation.

   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

   d) On the diagram below, draw arrows to show the pathway of air during exhalation.

   ________________________________________________________________
3. The diagram below shows part of the female reproductive system during pregnancy.

![Diagram](image)

**Fig. 1.2**

a) Name the parts labeled V and W.
   - V: ________________________________
   - W: ________________________________

b) What is the function of structure W?
   - _______________________________________________________________________
   - _______________________________________________________________________
   - _______________________________________________________________________

(c) Describe how the embryo shown in *Figure 1.2* is kept nourished inside the womb.
   - _______________________________________________________________________
   - _______________________________________________________________________
   - _______________________________________________________________________
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Question 2  

(20 marks)

1. The diagram shows a generalized reflex action.

a) Identify neurone $Y$.

______________________________________________________________________

b) Give an example of a reflex action.

______________________________________________________________________

______________________________________________________________________

c) Describe what happens in a reflex action.

______________________________________________________________________

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2. The diagram below shows the urinary system. It produces urine that contains urea.

[Diagram of the urinary system]

---

a) State where in the body urea is produced.

b) Describe what urea is produced from.

c) Explain the role of the urinary system in controlling urea level from accumulating to a dangerous, toxic level.

d) Kidney stone is a malfunction that occurs in the urinary system. Explain the causes of this malfunction and its effects on human.
3. The diagram below shows sample of a human blood.

![Diagram of human blood](image)

a) Use letters from the diagram above to complete the table. Use each letter only once.

<table>
<thead>
<tr>
<th>Functions</th>
<th>Letter</th>
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<tbody>
<tr>
<td>Transports oxygen around the body</td>
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<tr>
<td>Removes bacteria from the blood</td>
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<tr>
<td>Involves in blood clotting</td>
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<tr>
<td>Transports urea</td>
<td></td>
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</tbody>
</table>

b) Describe the significance of a circulatory system to the human body.

_________________________________________________________________________

_________________________________________________________________________

 c) Anaemia is a condition that develops when blood lacks red blood cells. Explain why women in the childbearing years are susceptible to anaemia.

_________________________________________________________________________

_________________________________________________________________________

4. The allele frequency for blood type AB is rarely found compared to other blood groups (Group A, B and O).

   List TWO environmental factors that can change the gene pool for Blood Group AB within a population.

   i. ________________________________________________________________

   ii. ________________________________________________________________
Question 3

1. The diagram shows a plant shoot and the same shoot twenty four hours later.

a) Describe your observation of the plant shoot after 24 hours.

b) Name the process that causes the observation in “a)” above.

c) State ONE environmental condition that could cause the change in the appearance of the shoot.

d) Explain how the environmental condition named in c) causes the change in the appearance of the shoot?

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________

____________________________________________________________________
2. The diagram below shows a section through part of a leaf.

Figure 2.1

a) Name the parts labeled A, B and C.

A: __________________________

B: __________________________

C: __________________________

b) Name the organelle found in part B.

_____________________________________________________________________

c) Write a **balanced chemical equation** for the process that occurs inside the section of the leaf labeled as part B.

_____________________________________________________________________

d) Explain with the aid of a diagram how the guard cells and stomata regulates gas exchange in plants.

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
3. The diagram below show gases being exchanged in plants during the day and night.

![Diagram showing gas exchange in plants during light and dark hours.]

a) Identify **Gas A** and **Gas B**.

Gas A: ________________________________

Gas B: ________________________________

b) Explain why the direction in which the gases stated in a) above changes during daylight and the dark hours of the night.

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Question 4  
(20 marks)

1. The diagram below shows some of the features of a typical wind pollinated flower.

[Diagram of a wind pollinated flower]

**Figure 2.2**

a) Define **pollination**.

___________________________________________________________________
___________________________________________________________________

b) Describe the features that make a typical wind-pollinated flower different from a typical insect-pollinated flower.

____________________________________________________________________
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___________________________________________


c) Draw a diagram to show the pathway in which a pollen travels to fertilize an egg of a wind-pollinated flower.

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</table>
2. The diagrams below show two different growth responses in plants.

![Diagram A](image1.png) ![Diagram B](image2.png)

a) State the type of growth response shown in diagrams A and B above.

A: ________________________________

B: ________________________________

b) Name a hormone that causes the growth responses of the plants in diagrams A and B.

____________________________________________________________________

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3. Distinguish **epigeal** seed germination from **hypogeal** seed germination.

____________________________________________________________________

____________________________________________________________________

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4. The diagram below shows a young dicotyledonous plant.

![Diagram of a young dicotyledonous plant]

a) On the diagram above, draw in circle A the distribution of the phloem and xylem as found in a section through a stem.

b) On Figure 2.3, draw the transpiration stream using arrows to indicate its direction.

c) What benefit does the transpiration stream have on plants?

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d) Rhizobium bacteria live inside the root nodules of legumes. The interaction between legumes and bacteria are said to be **mutualistic**. Explain what that means.

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</tbody>
</table>
Question 5 (20 marks)

1. The karyogram below shows the chromosomes present in the nucleus of a human cell.

![Karyogram of human chromosomes](image)

a) How many chromosomes would be present in a gamete from this person?
____________________________________________________________________

b) Explain why the chromosomes present inside the nucleus of a human cell exist in pairs.
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

Karyograms are increasingly being used in the field of genetics and medicine.

c) Give ONE use of karyotype in the field of medicine.
____________________________________________________________________
____________________________________________________________________
____________________________________________________________________

Karyograms are increasingly being used in the field of genetics and medicine.

d) Draw on the diagram above what the karyotype of a person with Down Syndrome may look like.
____________________________________________________________________
2. a) Discuss the development of human being in the early phase of life shown in the diagram below.

b) Compare mitosis and meiosis to state their significance in life continuity.
3. Study the diagram of the cell below then answer the questions that follow.

a) Name cell organelles A and B.
   A: ______________________________  B: ______________________________

b) State the functions of the cell organelles C and D.
   Functions of organelle C:
   ____________________________________________________________________

   Functions of organelle D:
   ____________________________________________________________________

(c) State whether the above cell was obtained from an animal cell or a plant cell.
   ____________________________________________________________________

(d) Justify your answer to c) above by giving examples from the diagram.
   ____________________________________________________________________
   ____________________________________________________________________
   ____________________________________________________________________
Question 6 (20 marks)

1. Lui and Semisi are identical twins. Identical twins are formed when an egg upon being fertilized by a sperm splits into two and eventually develops to form two embryo.

![Lui and Semisi](image)

The table below shows some information about some characteristics of Toni and Semisi.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Toni</th>
<th>Semisi</th>
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</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Male</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>161</td>
<td>162</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>55</td>
<td>58</td>
</tr>
<tr>
<td>Skin colour</td>
<td>Pale</td>
<td>Tanned</td>
</tr>
<tr>
<td>Hair style</td>
<td>Short hair</td>
<td>Long hair</td>
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<tr>
<td>Blood group</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

a) List the two characteristics that are only controlled by genetic information.

i. ____________________________________________________________

ii. ____________________________________________________________

b) Explain why Lui and Semisi being identical twins have different height, weight and skin colour.

______________________________________________________________________

______________________________________________________________________

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</table>
2. Colour blindness is a vision defect caused by a recessive gene, $X^r$, that is inherited as sex-linked genes. Normal vision ($X^R$) is dominant to colour blindness.

The pedigree below shows the inheritance of colour blindness in a family.

```
Colour Blindness

I

II

III

Key

Affected female

Affected male

Normal female

Normal male
```

a) Define **sex linked genes**.

______________________________

b) Give an example from the pedigree that gives good justification that colour blindness is inherited as a recessive gene. Explain your answer.

______________________________

______________________________

c) State the **genotypes** of Individuals 9 and 10.

Individual 9: ____________________  Individual 10: ____________________

d) Predict the ratios of the phenotype of their children. Show working.

______________________________

______________________________

______________________________

______________________________
3. The binomial naming system used to identify all living things gives the humpback whale a scientific name of *Megaptera novaeangliae*.

   a) Which part of the name refers to the genus and which part refers to the species?

      Genus: __________________________
      Species: _________________________

4. The diagram below shows the foodweb for chickens and birds.

   [Diagram of the foodweb showing chickens, birds, insects, slugs, worms, snails, flowers, leaves, and bark.]

5. State the trophic level of slugs and chickens.

   Slugs: ________________________________
   Chickens: ______________________________

6. Complete the food chain below using the information from the food web above.

   [Diagram with arrows showing the food chain: flowers → _______ → chickens]

7. Briefly describe why food chains rarely have more than four organisms within a chain.

   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________
Question 7 (20 marks)

1. The diagram below shows four different organisms.

   a) State the phylum that classifies organisms A, B, C and D.

      Organism A: ________________________________
      Organism B: ________________________________
      Organism C: ________________________________
      Organism D: ________________________________

   b) Describe the feature of organisms D that classify it in the phylum stated in a) above.

      _________________________________________________________________________

   c) Identify ONE structural adaptation of Organism A that enables it to survive in its environment.

      _________________________________________________________________________
2. Explain the difference between **habitat** of an organism and its **niche**.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

3. The diagram below shows the distribution of organisms in part of a rocky shore ecosystem.

![Diagram of rocky shore ecosystem]

a) Describe the distribution pattern displayed by the organisms in the diagram above.

________________________________________________________________________

________________________________________________________________________

b) State the environmental factor that causes the organisms to be distributed in the way shown in the diagram.

________________________________________________________________________
4. A group of students at Niuafo’ou District High School wanted to conduct a bird survey to estimate the population size of the endangered species of the malau. In their survey, the students collected a total of 15 malau, tagged a yellow band on the bird’s tarsus (foot) and then released them.

After two weeks, the same group of students was set out to estimate the population of the malau at Niuafo’ou. A total of 35 malau were found, 8 of which had the yellow band still tagged to their tarsus.

a) Name the method used by the group of students for estimating the malau population at Niuafo’ou.

_____________________________________________________

b) Calculate the population size of the malau birds at Niuafo’ou.

_______________________________________________________________________

_______________________________________________________________________

_______________________________________________________________________

_______________________________________________________________________

   c) Identify two possible sources of error the selected method has that may lead to an inaccurate estimation of the population size.

   i.   ___________________________________________________________________

   ii.  ___________________________________________________________________
SECTION C: LONG ANSWER QUESTIONS

Answer ALL questions in the spaces provided. You are required to write a paragraph explaining each topic. Marks will be awarded for answers that show a clear, accurate expression of ideas. Each question is worth 5 marks. Marking criteria are provided at the end of each question.

Question 1  (10 marks)

A group of biology students used a potometer to investigate the rate of water uptake of a leafy shoot under six different sets of conditions. The results of the investigation were recorded and displayed on the table below.

<table>
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<th>wind speed</th>
<th>mean rate of movement of gas bubble / mm h⁻¹</th>
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<td>15</td>
<td>low</td>
<td>12</td>
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<tr>
<td>2</td>
<td>15</td>
<td>high</td>
<td>22</td>
</tr>
<tr>
<td>3</td>
<td>25</td>
<td>low</td>
<td>24</td>
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<tr>
<td>4</td>
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<tr>
<td>6</td>
<td>35</td>
<td>high</td>
<td>120</td>
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</tbody>
</table>

Study the data carefully then complete the following part of the scientific write-up of the lab report.

a) **Aim:**

b) Evaluate the result displayed on the table to explain the effect of temperature and wind speed on the rate of water uptake.
c) Display the result shown in the table on a graph below to show the trend of the effects of temperature and windspeed on the rate of water uptake. Label the axis and graphs clearly.
Question 2

(10 marks)

Diagrams A and B shows how forests are sometimes cleared by “slash and burn”, in which the trees and other plants are cut down and burnt.

Study the diagrams carefully and then analyze the effect of human activities on the environment. The following sections should guide your analysis.

Effects that “slash and burn” deforestation can have on the carbon cycle.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

Effects deforestation can have on the soil.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

For Marker’s use only.
Effects deforestation can have on wildlife.

____________________________________________________________________________
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Summary of Analysis

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
ANSWER SHEET – SECTION A
Write the letter of the correct answer only.

MULTIPLE CHOICE

1.  11.  

2.  12.  

3.  13.  


5.  15.  

6.  16.  

7.  17.  

8.  18.  

9.  19.  

10.  20.  

Number of correct answer \( \times 2 \) = 40

BIOLOGY 2015

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(For Official Use Only)

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