TONGA GOVERNMENT
MINISTRY OF EDUCATION AND TRAINING

TONGA SCHOOL CERTIFICATE
2014
BIOLOGY

QUESTION AND ANSWER BOOKLET

Time Allowed: 3 Hours plus 10 minutes reading time.

INSTRUCTIONS
1. This paper consists of THREE COMPULSORY sections.

   SECTION A : Multiple Choice Questions        40 Marks
   SECTION B : Short Answers Questions         140 Marks
   SECTION C : Extended Response Questions     20 Marks

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

3. Attempt all questions in the spaces 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 not have 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 questions given.

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

TOTAL MARKS

200
SECTION A  MULTIPLE CHOICE  (40 MARKS)

Write the letter of the BEST answer in the Multiple Choice Sheet provided at the end of this Booklet.

1. A food chain is represented below.

| lu leaves | → | worms  | → | chickens | → | dogs |

This food chain contains _________________________________.

A. 4 consumers and no producers
B. 2 carnivores and 2 herbivores
C. 1 predator, 1 parasite and 2 producers
D. 2 predators, 1 herbivore and 1 producer

2. Which ORDER of Animal Groups correctly show structural features of most legs to fewest legs?

A. arachnids → crustaceans → insects → myriapods
B. crustaceans → myriapods → insects → arachnids
C. insects → arachnids → myriapods → crustaceans
D. myriapods → crustaceans → arachnids → insects

3. The aquarium ecosystem in Figure 1 below is a shot from this year’s Agriculture Show. A community in this aquarium consists of the:

Figure 1

A. fish, plants and snails.
B. fish, water and snails.
C. plants, water, pebbles.
D. water, fish, pebbles.
4. Figure 2 below shows an area being developed for industry and agriculture near Fangatapu Seashore area?

If FLOODING may occur, which of the followings would most likely be the main cause?

A. excess herbicides and fertilizers  
B. high demand for agriculture land  
C. industrial development of factory  
D. sulphur dioxide reaction with rain

5. Graph 1 below shows the change in population size for three (3) freshwater pond species.

Graph 1 : Population Changes in Freshwater Ponds
**Animal Y** was in abundance when animals **X and Z** were introduced. Animal **X** preys on Animal **Y**, Animal **Z** preys on Animal **X**. Which of the followings correctly identifies the interspecific competition among each animal that results in a change in the population size?

<table>
<thead>
<tr>
<th></th>
<th>Line 1</th>
<th>Line II</th>
<th>Line III</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Animal X</td>
<td>Animal Y</td>
<td>Animal Z</td>
</tr>
<tr>
<td>B</td>
<td>Animal Y</td>
<td>Animal X</td>
<td>Animal Z</td>
</tr>
<tr>
<td>C</td>
<td>Animal Y</td>
<td>Animal Z</td>
<td>Animal X</td>
</tr>
<tr>
<td>D</td>
<td>Animal Z</td>
<td>Animal Y</td>
<td>Animal X</td>
</tr>
</tbody>
</table>

6. **Figure 3** below represents a nucleotide with subunits **X, Y and Z**.

![Figure 3](image_url)

This nucleotide could be identified as a monomer of DNA but not RNA if:

A. X is a ribose sugar.
B. Z is named thymine.
C. Y is the phosphate.
D. Z is paired with Cytosine.

7. Which statement best describe the crossing over of chromosomes?

A. DNA molecules called genes swap over during mitosis.
B. DNA molecules called genes swap each other during meiosis.
C. Genes cause recombination during mitosis cell division.
D. Genes that are homologous separate during meiosis cell division.
8. DNA was incubated with radioactive nucleotides. After one cycle of Replication Process, the distribution of radioactive and non-radioactive nucleotides in the DNA would be?

9. Which cell shows the position of the nucleus correctly?

10. **Figure 4** below show parts of an insect – pollinated flower? Which number correctly matches each part?

   **Figure 4**

<table>
<thead>
<tr>
<th>Petals</th>
<th>Stigmas</th>
<th>Anthers</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>B</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>
11. **Figure 5** below shows a germinated bean seed with a horizontal radicle. The germinating seed was placed on a slowly rotating disc and is left for three days.

![Figure 5](image)

Which diagram shows the appearance of the radicle after three days?

A. 
B. 
C. 
D. 

12. Five similar plants are placed in test-tubes as shown in **Figure 6**. Some of the plants have their leaves coated with grease to reduce transpiration. Each plant is weighed in its test-tube at the start of the experiment and and again two days later. **Table 1** shows the result of the experiment.

![Figure 6](image)

<table>
<thead>
<tr>
<th></th>
<th>mass/g</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>plant 1</td>
</tr>
<tr>
<td>at the start of</td>
<td>105</td>
</tr>
<tr>
<td>experiment</td>
<td></td>
</tr>
<tr>
<td>after two days</td>
<td>103</td>
</tr>
</tbody>
</table>

Which **plants 1-5** did not coat its leaves with grease?

A. 1, 2 and 3
B. 1, 2 and 4
C. 2, 4 and 5
D. 2, 3 and 5
13. **Figure 7** below shows a vertical section through the carpel of a flower with a seed been pollinated.

What is the correct order of structure through which the pollen tube must grow in order to bring about fertilization?

<table>
<thead>
<tr>
<th>First</th>
<th></th>
<th>Last</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Microphyle</td>
<td>Stigma</td>
<td>Style</td>
</tr>
<tr>
<td>B Ovary wall</td>
<td>micropyle</td>
<td>Stigma</td>
</tr>
<tr>
<td>C Stigma</td>
<td>Style</td>
<td>Ovary wall</td>
</tr>
<tr>
<td>D Style</td>
<td>Ovary wall</td>
<td>Micropyle</td>
</tr>
</tbody>
</table>

14. Which diagram shows BEST the flow of blood in the human double circulatory system?
15. The followings 1-5 are involved in the process of cellular respiration:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Energy</td>
</tr>
<tr>
<td>2</td>
<td>Carbohydrates</td>
</tr>
<tr>
<td>3</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>4</td>
<td>Water</td>
</tr>
<tr>
<td>5</td>
<td>Oxygen</td>
</tr>
</tbody>
</table>

Which equation correctly represent its involvement in the process of cellular respiration?

A. \( 2 + 3 = 1 + 4 + 5 \)
B. \( 2 + 4 = 1 + 3 + 5 \)
C. \( 1 + 2 = 3 + 4 + 5 \)
D. \( 2 + 5 = 1 + 3 + 4 \)

16. **Figure 8** below shows a section of the human brain and the spinal cord.

Which ROW correctly matches the labelled structures above?

<table>
<thead>
<tr>
<th></th>
<th>Cerebral hemisphere</th>
<th>Cerebellum</th>
<th>Medulla</th>
<th>Pituitary gland</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>P</td>
<td>Q</td>
<td>R</td>
<td>S</td>
</tr>
<tr>
<td>B</td>
<td>P</td>
<td>R</td>
<td>Q</td>
<td>S</td>
</tr>
<tr>
<td>C</td>
<td>Q</td>
<td>R</td>
<td>S</td>
<td>P</td>
</tr>
<tr>
<td>D</td>
<td>S</td>
<td>P</td>
<td>Q</td>
<td>R</td>
</tr>
</tbody>
</table>
17. **Figure 9** below represents a blood capillary with an adjacent cell. The arrows represent the transfer of substances between the capillary and the cell.

Which arrows represent the glucose, carbon dioxide and oxygen?

<table>
<thead>
<tr>
<th>Glucose</th>
<th>Carbon Dioxide</th>
<th>Oxygen</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>P</td>
<td>R</td>
</tr>
<tr>
<td>B</td>
<td>Q</td>
<td>S</td>
</tr>
<tr>
<td>C</td>
<td>R</td>
<td>Q</td>
</tr>
<tr>
<td>D</td>
<td>S</td>
<td>P</td>
</tr>
</tbody>
</table>

18. Which of the following homeostatic processes restores homeostatic balance when an athlete gives off excessive sweat during heavy trainings?

A. The kidneys frequent excretion of excessive urine.
B. Reabsorption of water by the blood capillaries in the nephron.
C. The loop of Henle reabsorbing more salts from the blood capillaries.
D. Secretion of Insulin which converts glucose to glycogen.
19. **Figure 10** below illustrates **Stages 1-4** in the development of life of a human.

Which processes BEST describe each stage?

<table>
<thead>
<tr>
<th>Fertilization</th>
<th>Growth</th>
<th>Development</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Stage 1</td>
<td>Stage 2</td>
<td>Stage 3</td>
</tr>
<tr>
<td>B Stage 2</td>
<td>Stage 1</td>
<td>Stage 3</td>
</tr>
<tr>
<td>C Stage 2</td>
<td>Stage 3</td>
<td>Stage 4</td>
</tr>
<tr>
<td>D Stage 4</td>
<td>Stage 3</td>
<td>Stage 2</td>
</tr>
</tbody>
</table>

20. Meristematic cells of primary and secondary plants are found in the followings EXCEPT;

A. bud of a flower.
B. roots of a plant.
C. root hairs of roots.
D. shoots of a tree.
SECTION B   SHORT ANSWER QUESTIONS   (140 MARKS)

THIS SECTION CONSISTS OF SEVEN QUESTIONS. ATTEMPT ALL questions in the spaces provided.

QUESTION 1:   (20 marks)

1. Figure 11 below shows a cell and cell organelles. Study the diagram to answer questions that follow.

   a. Is the cell a plant cell or an animal cell?

   ___________________________________________________________  (1 mark)

   b. Justify a reason to your answer in a. above?

   ___________________________________________________________  (1 mark)

   c. State the significant roles of W and Q.

   W: ___________________________________________________________  (2 marks)

   Q: ___________________________________________________________  

   d. If structure P is removed, explain how would it affect the cell?

   ___________________________________________________________  (1 mark)
2. **Figure 12** below shows a few pairs of chromosomes found in an individual, plus the chromosomes that determines the sex of the individual. Each chromosome has been labelled with a letter.

![Figure 12](image_url)

a. Using the letters A-J, complete the table by listing the pairs of chromosomes that correctly matches each other. You will find that one pair does not match.

<table>
<thead>
<tr>
<th>Matching Pairs of Chromosomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

(2 marks)

b. State the non-matching pair and explain what can be concluded about the phenotype of the individual.

____________________________________________________________________________
____________________________________________________________________________

(1 mark)

c. The non-matching pairs were identified later to be sex linked. Explain the meaning of this.

____________________________________________________________________________

(1 mark)
3. **Figure 13** below shows the illustration of a cob of maize.

![Figure 13](image)

a. Count the number of grains for each color.

White : __________________________  Black ; __________________________

(1 mark)

b. What genetic ratio do these figures suggest?

(1 mark)

c. If the letter ‘A’ represents the allele for White color and lower case ‘a’ for Black color.

i. State the possible genotypes of the parent plants for this cob.

(1 mark)
ii. Complete the genetic diagram to show how the genetic ratio in b. on page 13 was produced.

![Genetic Diagram]

iii. How does this result support Mendel’s experiment? (2 marks)

(1 mark)
4. **Figure 14** below shows a potato tuber which developed from the stem of a parent potato plant. Three shoots are starting to grow from the tuber.

**Figure 14**

![Diagram of a potato tuber with shoots]

a. **Figure 14** is an example of which type of reproduction?

____________________________________________________________________________

(1 mark)

b. Explain your answer in a. above?

____________________________________________________________________________
____________________________________________________________________________

(1 mark)

c. Which type of cell division indicates the growth of the three shoots?

____________________________________________________________________________

(1 mark)

d. With the support of your answer in c., explain how the genotypes of the shoots compare with the genotypes of the tuber and of the parent?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(2 marks)
QUESTION 2: (20 marks)

1. Figure 15 below shows the external features of an animal.

**Figure 15**

![Image of an animal](image_url)

a. To which group of Arthropods does the animal belong to?

____________________________________________________________________________

(1 mark)

b. Suggest a reason to your answer in a. above.

____________________________________________________________________________

(1 mark)

c. ‘Survival’ is the essence of adaptation. Define the term ‘adaptation’.

____________________________________________________________________________

(1 mark)

d. Explain the behavioral adaptation of the animal and its role for the survival in its habitat?

____________________________________________________________________________

____________________________________________________________________________

(1 mark)
2. A relationship in a community identified that small insects were eaten by birds which were feeding on the caterpillars that are eating the leaves of a tree.

**Figure 16:** shows the Pyramid of Numbers of the relationship.

![Pyramid of Numbers](image)

a. In the space below, **draw and label** how the relationships would be displayed in a **Pyramid of Biomass**.

**Figure 17**

![Pyramid of Biomass](image)

(2 marks)

b. Compare each pyramid in **Fig 16 & 17** above and make judgment on why the pyramids are represented differently?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

(2 marks)
3. Interactions of organisms in a community is symbolized in Table 2 below. Study it and write the interaction number 1,2,3 or 4 where appropriate.

**Table 2 : Instructions:**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Organism A</td>
<td>→</td>
<td>Organism B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organism B</td>
<td>→</td>
<td>Organism A</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Organism A</td>
<td>→</td>
<td>Organism B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organism B</td>
<td>→</td>
<td>Organism A</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Organism A</td>
<td>→</td>
<td>Organism B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organism B</td>
<td>→</td>
<td>Organism A</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Organism A</td>
<td>→</td>
<td>Organism B</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organism B</td>
<td>→</td>
<td>Organism A</td>
<td></td>
</tr>
</tbody>
</table>

**Key:**

- = Positive Effect
- - = Negative Effect
- - - - - = No Effect

---

a. Ants (Organism A) defend acacia trees (organism B) from attacks by insects that are herbivores. The ants live in the hollow thorns of the trees.

(1 mark)

b. Birds (organism A) feed on parasites that live on the body of cows (organism B). The cow allows the birds to feed off the parasites.

(1 mark)

c. Wasps (organism A) obtain nutrition on tomatoe hornworms (organism B). The hornworm does not survive.

(1 mark)

d. State the biological term used to describe Interaction number 2.

(1 mark)
4. A few Form 5 Biology students wished to evaluate the abundance of each species on an area of rock platform. They decided to place four quadrats within the area. **Figure 18** shows an area of a rock platform with three species and the location of four quadrats.

**Figure 18**

---

a. Describe why it was appropriate to use a *quadrat*?

____________________________________________________________________________

(1 mark)

b. In **Table 3** below, record the samples of each THREE (3) species in the labeled quadrats.

**Table 3**

<table>
<thead>
<tr>
<th>Quadrat number</th>
<th>Species 1 Melanerita</th>
<th>Species 2 Austrocochlea</th>
<th>Species 3 Crab</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(3 marks)
c. What term is used to describe the distribution of all species in this community?

____________________________________________________________________________

(1 mark)

d. If each quadrat used was 1m x 1m in dimension and the total area was 19.2 m², calculate the population size of the Melanerita species in the whole area? Show all working.

Population size = \( \frac{\text{Total area} \times \text{Total sample}}{\text{Area of Quadrat}} \)

____________________________________________________________________________

(1 mark)

e. Suggest at least ONE (1) abiotic and biotic factor that may affect the distribution in this community?

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(2 marks)
QUESTION 3:  

(20 marks)

1. **Figure 19** below shows a section of the digestive tube in human.

![Figure 19](image)

a. Identify **Figure 19** and indicate which part of the digestive system are they found?

____________________________________________________________________________
____________________________________________________________________________

(1 mark)

b. Suppose **Figure 19** is malfunctioned. Explain how it would affect the flow of BLOOD from B to A and C.

____________________________________________________________________________
____________________________________________________________________________

(1 mark)

c. Explain ONE (1) way by which **Figure 19** is adapted to its vital role in the digestive system.

____________________________________________________________________________
____________________________________________________________________________

(1 mark)
2. **Table 4** below illustrates the type of food consumed by various animals in an ecosystem. Examine the table and answer the following questions.

**Table 4:**

<table>
<thead>
<tr>
<th>Animals in the Community</th>
<th>Food Consumed in the Community</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Shrews</td>
</tr>
<tr>
<td>Shrews</td>
<td></td>
</tr>
<tr>
<td>Hawks</td>
<td>X</td>
</tr>
<tr>
<td>Grasshoppers</td>
<td></td>
</tr>
<tr>
<td>Spiders</td>
<td></td>
</tr>
<tr>
<td>Snakes</td>
<td></td>
</tr>
</tbody>
</table>

a. Sketch a Food web from the table above.

b. Explain what will most likely happen if the followings occur?

i. If shrews are removed, how does that affect the hawk’s population?

   ______________________________________________________
   ______________________________________________________
   ______________________________________________________

   (1 mark)
ii. If plants are removed, how does that affect the shrew population?

_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

(1 mark)

c. **Figure 20** below simplifies the scheme for energy flow through the ecosystem above.

**Figure 20**

![Energy Flow Diagram]

1. **Autotrophs**
2. **Heterohops**

3. Arrows indicate energy flow:
   - 1: From Autotrophs to Heterohops
   - 2: From Heterohops to Autotrophs
   - 3: From Heterohops to Respiration

In relation to the terms; **feeding, photosynthesis and respiration**, briefly discuss how it supports the flow of energy illustrated above.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(4 marks)
3. Farmers often collect fallen leaves in autumn and place them on compost heaps. Over the next year or so the leaves decay.

**Figure 21**

![Diagram showing the process of leaves falling from a tree, being collected by a gardener, and placed on a compost heap.]

a. Who is responsible for the leaves decay?

____________________________________________________________________________

(1 mark)

b. Explain the role of the organisms in a. above?

____________________________________________________________________________

(1 mark)

c. The leaves decay more quickly in summer than in winter? Give a reason why?

____________________________________________________________________________

(1 mark)
4. Pollutants can affect the environment. Analyse the information and write the LETTER in the box provided that best describes each pollutant and effect it might have on the environment.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Effect on the environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Methane</td>
<td>B. Cause the rise of global temperature.</td>
</tr>
<tr>
<td>3. Sulphur Dioxide</td>
<td>C. Lead to acid rain.</td>
</tr>
<tr>
<td></td>
<td>E. Reduce the level of O₂ in the blood system.</td>
</tr>
</tbody>
</table>

1. __________________________
2. __________________________
3. __________________________
4. __________________________

(4 marks)
1. **Figure 22** below shows a cross-section through a leaf.

   **Figure 22**

a. If ONE (1) blackish organelle present in structures 1 and 5 is enlarged, indicate the name of this blackish organelle.

   ________________________________________

   (1 mark)

b. Structures 1 and 5 are located on different positions yet function similarly. Describe this function.

   __________________________________________________________________________
   __________________________________________________________________________

   (1 mark)

c. Describe TWO (2) adaptations of structures 1 and 5 which contribute to its function.

   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________
   __________________________________________________________________________

   (2 marks)

d. Structures 2 and 3 are located in the same position yet function differently. State the name of this part of the leaf.

   ________________________________________

   (1 mark)
2. **Graph 2** shows the effect of light intensity on the rate of photosynthesis from an experiment.

![Graph 2](image)

a. Study the graph and write a conclusion to the experiment explaining ‘TWO TRENDS’ of the graph.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(2 marks)
3. **Figure 23** below show the appearance of upper and lower surfaces of ONE (1) leaf under a microscope. Study the diagrams and answer the questions that follow.

**Figure 23**

---

a. Name structure **X**.

____________________________________

(1 mark)

b. Part **Y** is a gas. If it was 12:00am, which gas would function at this time and why?

____________________________________________________________________________

____________________________________________________________________________

(2 marks)

c. Why is structure **X** found mainly on the lower surface of the leaf?

____________________________________________________________________________

(1 mark)

d. Draw and label structure **X** when it is closed.

____________________________________________________________________________

(2 marks)
4. A Form 5 student set up an experiment to observe the process of Translocation. The student used a dicotyledon plant as below which shows three lines (——) with no arrows.

**Figure 24**

a. Define the term ‘translocation’?

____________________________________________________________________________
____________________________________________________________________________

(1 mark)

b. On ALL three lines, draw arrow HEADS to show the direction of translocation?

____________________________________________________________________________

(1 mark)
c. On the other hand, the student noted that the tested earlier was taken from two identical plants, S and T, that were planted in either side of a house as shown in Figure 25 as below. Study the diagram and answer the questions that follow.

![Figure 25]

Identical plants, S and T, put either side of a house

The volume of water was measured form each plant over a two hour period from 9:00 am. The results are shown in Graph 3 below. Analyze the graph and answer the questions that follow.

![Graph 3]
i. What **biological term** is used to describe the loss of water from plants?

____________________________________________________________________________

(1 mark)

ii. Compare each plant and suggest a reason why the huge difference in the volume of water loss.

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

(2 marks)

iii. Critically explain where and how the process started and where it ends.

Where it started and how: ______________________________________________________

____________________________________________________________________________

(1 mark)

Where it ends and how: ______________________________________________________

____________________________________________________________________________

(1 mark)
QUESTION 5: (20 marks)

1. Figure 26 below shows section through a flower.

   ![Figure 26]

   **Figure 26**

   a. What type of reproduction occurs if a flower is present?

   ________________________________

   (1 mark)

   b. Explain your answer in a. above using numbers 1-4.

   ________________________________
   ________________________________

   (1 mark)

   c. How would this type of reproduction benefit plant species?

   ________________________________
   ________________________________

   (1 mark)
d. Study each structure and provide reasons why structure 4 has an important role in plants.

____________________________________________________________________________

____________________________________________________________________________

(1 mark)

e. Which number(s) represent the Stamen of the flower?

__________________________________________

(1 mark)

f. Describe how has the structural feature of the flower support its role of pollination?

____________________________________________________________________________

(1 mark)

g. If structure 3 is removed, explain how it would affect the type of reproduction in plants?

____________________________________________________________________________

____________________________________________________________________________

____________________________________________________________________________

(1 mark)

2. Figure 27 below shows a germinating bean seed with the seed coat removed.

Figure 27
a. Illustrate in the BOX below how a response to a HYPOGEAL germination may occur? Use the letters X, Y and Z in Figure 27 to show this response.

3. **Graph 4** shows the effect of storage time on the germination of some seeds.

   **Graph 4:**

   ![Graph 4](image)

   a. Formulate an appropriate hypothesis for the result.

   (1 mark)

   b. Examine **Graph 4** and complete the data below in **Table 5**. The first data has been completed for you.

   **Table 5**

<table>
<thead>
<tr>
<th>Storage time / years</th>
<th>% Germination</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

   (2 marks)
c. From the data on page 34 (Table 5), predict % germination of the seed in 10 years?

____________________________________________________________________________

(1 mark)

4. Compare the following terms and define each meaning with supported examples.

a. habitat and niche

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(2 marks)

b. Population and Ecosystem

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(2 marks)

c. nervous and endocrine system

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(2 marks)
1. **Figure 28** below is a schematic representation of part of the human digestive system.

   a. Name the part of the alimentary canal that is represented by A.

   ____________ (1 mark)

   b. Describe with names the processes represented by the arrows X and Y.

   X: ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

   Y: ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

   (2 marks)

   c. If B is starch or carbohydrate, explain what would molecule ‘C’ be in the bloodstream?

   __________________________________________________________________
   __________________________________________________________________
   __________________________________________________________________

   (1 mark)

   d. What happens when EXCESS of ‘C’ is obtained by the body?

   __________________________________________________________________

   (1 mark)
2. **Figure 29** below is an alveolus which is found in large amount in the human lung.

![Figure 29]

a. What significant role is played by the alveolus?

____________________________________________________________________________
____________________________________________________________________________

(1 mark)

b. Using choices of letter A to F, explain how ‘G’ is responsible for this process to occur.

____________________________________________________________________________
____________________________________________________________________________

(1 mark)

c. Give ONE (1) reason, how the alveolus can function efficiently in human.

____________________________________________________________________________
____________________________________________________________________________

(1 mark)
3. An athlete takes part in a race. **Graph 5** shows her breathing rate before, during and after the race.

![Graph 5](image)

a. In relation to the process of inhalation, explain how it functions at point A to B. Use the terms intercostal muscles, diaphragm and chest to support your answer.

___________________________________________________________________________
___________________________________________________________________________

(1 mark)

b. Before the end of the race (point B – C), the athlete complained to have muscle cramps. What can you say about the athlete?

___________________________________________________________________________
___________________________________________________________________________

(1 mark)
4. A certain hormone produced by the human body during emergencies, has the following effects:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>increases heartbeat</td>
</tr>
<tr>
<td>B.</td>
<td>it causes the arteries supplying the gut to contract</td>
</tr>
<tr>
<td>C.</td>
<td>it causes the arteries supplying the liver and muscles to expand.</td>
</tr>
</tbody>
</table>

a. Provide the name of the hormone and the gland that brings about the changes above.

_________________________________________  (1 mark)

b. Explain why the hormone has a different or opposite effect on the arteries to the gut and muscle.

____________________________________________________________________________
____________________________________________________________________________  (1 mark)

5. **Figure 30** below shows few structures involved in a Reflex Action when a girl picks up a hot plate.

[Figure 30: A diagram showing reflex action]
a. If the girl picked up the hot plate a reflex action forced her to drop the plate immediately. Explain how this is possible. Use the correct names of letters given on the diagram, Figure 30, to support your answer.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(1 mark)

b. Explain ONE (1) effect on the body if part C is damaged.

____________________________________________________________________________

(1 mark)

c. What would be ONE (1) example of a feedback that involves structure 'E'?

____________________________________________________________________________

(1 mark)

6. Figure 31 below is a section of the excretory system. Study the diagram and answer the questions that follow.

Figure 31

![Diagram of the excretory system]

a. Provide a name to the organ tissue represented in the diagram.

____________________________________________________________________________

(1 mark)
b. Similar process functions in number 2 and 3 although in different directions. What is this process?

____________________________________________________________________________________

(1 mark)

c. The result of blood flow from A to C and from 1 to 3 is recorded in Table 6 below. With critical analysis, use the data to answer the questions that follow.

Table 6

<table>
<thead>
<tr>
<th>SUBSTANCE</th>
<th>% IN PLASMA</th>
<th>% IN FILTRATE</th>
<th>% IN URINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>90–93</td>
<td>99–100</td>
<td>97.5</td>
</tr>
<tr>
<td>Protein</td>
<td>7.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Glucose</td>
<td>0.10</td>
<td>0.10</td>
<td>0</td>
</tr>
<tr>
<td>Salts</td>
<td>0.35</td>
<td>0.35</td>
<td>0.50</td>
</tr>
<tr>
<td>Urea</td>
<td>0.03</td>
<td>0.03</td>
<td>2.00</td>
</tr>
</tbody>
</table>

i. Which substance (s) present in the plasma did not filter into the Bowsman’s capsule? Give a reason for this.

____________________________________________________________________________________

____________________________________________________________________________________

(1 mark)

ii. Suggest an explanation for each of the followings:

no glucose in the urine %.

____________________________________________________________________________________

____________________________________________________________________________________

a higher concentration of salts in the urine that in the filtrate.

____________________________________________________________________________________

____________________________________________________________________________________

(1 mark)

iii. Give ONE (1) possible reason why glucose is sometimes present in the urine of a person.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

(1 mark)
1. **Figure 32** below summarizes the early stages of sexual reproduction in human.

   ![Figure 32](image)

   a. i. After examining **Figure 32**, is the human male or female?
      
      ____________________________________________________________ (1 mark)

   ii. Suggest a reason to your answer in a. i. above.
      
      ____________________________________________________________ (1 mark)

   b. Using the LETTERS, explain how **Figure 32** supports sexual reproduction?
      
      ____________________________________________________________
      ____________________________________________________________ (1 mark)

   c. Where in the human reproductive organ, stated in your answer in a. above would the followings occur?
      
      i. Combination of **R** and **S** : ____________________________

      ii. Growth from **T** to **W** : ____________________________ (2 marks)
2. Sione wanted to do some ‘pull ups’ on a horizontal bar. **Figure 33** shows his movements.

![Figure 33](image)

**Position X**

**Position Y**

a. In moving from the lower **Position X** to the upper **Position Y**, muscles and joints function together. Select from the list of words below, at least three (3) appropriate terms, to explain how the muscle and joints function to allow movement from X to Y.

**List of words:**

- Elbow joint
- Ball and socket joint
- Biceps
- Triceps
- Ankle joint
- Arm
- Hand
- Bone

i. ______________________________________

ii. ______________________________________

iii. ______________________________________

(3 marks)

b. What **biological term** is used to describe how the muscle and joints function?

____________________________________________________________________________

(1 mark)

c. While moving up and down the bar, Sione felt pain on his arm. Give ONE (1) reason for this pain.

____________________________________________________________________________

(1 mark)
3. **Figure 34** below shows an external view of the heart.

![Figure 34](image)

**a.** What is the function of ‘**coronary artery**’ in the heart?

__________________________________________________________

(1 mark)

**b.** A blood clot is stuck at **X**. Explain what will happen to the heart muscle cells in the shaded area.

__________________________________________________________

__________________________________________________________

(1 mark)

**c.** List at least ONE (1) ACTION, people can take to reduce the risk of having a blood clot in the coronary artery.

__________________________________________________________

__________________________________________________________

(1 mark)
4. **Table 7** below shows collective data of the top ten causes of death in parts of the world during 2010.

**Table 7**

<table>
<thead>
<tr>
<th>cause of death</th>
<th>percentage of the deaths of adult males</th>
<th>percentage of the deaths of adult females</th>
</tr>
</thead>
<tbody>
<tr>
<td>cancer (lung, alimentary canal, breast, prostate and others)</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>coronary heart disease</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>stroke (blood clot in brain)</td>
<td>17</td>
<td>10</td>
</tr>
</tbody>
</table>

From the data, a Bar **Graph number 5** is provided showing the adult males results only.

![Graph 5](image)

a. Draw on the bar graph above the results of the adult females. (1 mark)

b. Suggest ONE (1) reason why females’ deaths of coronary disease are much higher than male.

______________________________________________________________________
______________________________________________________________________

(1 mark)
5. The image in Figure 35 below is a karyotype of a child.

Figure 35

a. The total number of homologous chromatids in this karyotype would be?

____________________________________________________________________________

(1 mark)

b. The child is abnormal. State the name of this disorder in human.

____________________________________________________________________________

(1 mark)

c. Explain the reason for this disorder.

____________________________________________________________________________

____________________________________________________________________________

(2 marks)

d. Why is a karyotype essential to be used by biologists?

____________________________________________________________________________

(1 mark)
Answer ALL questions in the spaces provided. You are required to write a paragraph and critically discuss each topic. Marks will be awarded for answers that show clear and accurate expressions of ideas. A marking criterion is provided with diagrams to assist discussions.

**TOPIC 1:**
**Figure 36** below illustrates the **Blood Vessels** in the Circulatory System (CS).

![Figure 36](image)

Compare and contrast each vessel in terms of its name, function and its relationship with the Respiratory System (RS).

__________________________________________________________________________________
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__________________________________________________________________________________
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<table>
<thead>
<tr>
<th>Criteria</th>
<th>Marks Allocated</th>
<th>Marks Awarded</th>
</tr>
</thead>
<tbody>
<tr>
<td>Names of each vessel 1-4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Functions of each vessel 1-4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Relationship of RS and CS</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>5</strong></td>
<td></td>
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</tbody>
</table>

P.47
Figure 37 shows a few nerve pathways responsible in controlling temperature of the human body.

![Figure 37](image)

Analyze the diagram and discuss how structure X controls the regulation of temperature in each body tissue of the human skin.

__________________________________________________________________________________
__________________________________________________________________________________
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<table>
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<th>Criteria</th>
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<tr>
<td>Structure X</td>
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</tr>
<tr>
<td>Receptor</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sweat gland</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Blood vessel</td>
<td>1</td>
<td></td>
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<tr>
<td>Surface of Skin</td>
<td>1</td>
<td></td>
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<tr>
<td><strong>Total</strong></td>
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<td></td>
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</table>
TOPIC 3:

Figure 38 below summarizes the steps involved in the production of a cloned sheep. Analyze the steps and critically discuss, using the diagram, what is cloning? Suggest at least TWO (2) advantages and disadvantages of cloning sheep’s into the farming system.

Figure 38
**TOPIC 4:**

The ideal concept of ‘movement’ in plants is evidenced by the process of plant tropisms. With clear definitions of plant movement, discuss the external stimuli responsible for the following types: Phototropism, Chemotropism, Hydrotropism and Thigmotropism. Include in your discussion TWO (2) hormones and its role in this movement concept.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Marks Allocated</th>
<th>Marks Awarded</th>
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<tbody>
<tr>
<td>Definition of Plant Tropisms</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Phototropism, Chemotropism, Hydrotropism, Thigmotropism</td>
<td>2 ( ½ mark each term )</td>
<td></td>
</tr>
<tr>
<td>Hormones responsible with correct roles, and how it occurs to stimulate movement.</td>
<td>2 ( ½ mark for each hormone and ½ for each role )</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>
ANSWER SHEET – SECTION A
Write the letter of the correct answer only.

<p>| | | | |</p>
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<thead>
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<tr>
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BIOLOGY 2014
SECTIONS TOTALS
(For Official Use Only)

<table>
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<th>Check Mark</th>
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<td>Q.5</td>
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X 2 = SECTION A

40