INSTRUCTIONS

1. Write your Student Personal Identification Number (SPIN) on the right corner of this booklet and on the last page.
2. There are three sections in this paper. **ALL SECTIONS ARE COMPULSORY.**
3. Answer the questions in the spaces provided in this booklet. If you need more space for your answers, ask the supervisor for extra paper. Write your SPIN on all extra sheets used and number the questions clearly.
4. Note that you may not have seen or studied any of the organisms used as examples in this paper. You are expected to apply the principles and knowledge learned during your Biology Course.
5. This examination consists of **THREE** Sections. Recommended time allowances are suggested to consider at each section:

   - **Section A:** Multiple Choice Questions 40 marks 1 hr.
   - **Section B:** Short Answer Questions 140 marks 1 ½ hrs.
   - **Section C:** Extended Response Questions 20 marks ½ hr.

6. Check that this booklet contains pages 1-52 in the correct order. Pages 48-50 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    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. The role of a nucleus organelle in eukaryotic and prokaryotic cells is to

   A. direct all chemical reactions occurring in both cells.
   B. carry out the translation process for production of protein.
   C. act as a water storage and water usage for all cell activities.
   D. control the regulation of materials into and out of both cells.

2. Two enzyme experiments were carried out. Experiment X (___) was carried out first at a constant temperature of 37°C. During a second experiment (___) the temperature was increased from 37°C to 80°C.

Which graph illustrates the result of how 'change of temperature' affects the rate of how enzyme functions?

A

B

C

D

3. Form 6 Biology students investigated the taxonomy classification of plant species under the phylum & sub-phylum divisions:
   
   **Algae, Fungi, Lichens, and Ferns.**

Which of the following is found common among the plant species?

A. Vascular tissues for water transport.
B. Seeds for plant growth and germination.
C. Flowers for sexual reproduction process.
D. Leafy like structures for glucose formation.
4. **Fig. 1** shows a portion of an electron photomicrograph of a chloroplast. Use Fig 1 to answer Questions 4 & 5.

![Fig 1.](image)

Considering structure **Q** and **P**, which of the following terms best describes the two?

A. Q – Stroma, P – Grana.
B. Q – Grana, P – Stroma.
C. Q – Stomata, P – Grana.
D. Q – Grana, P – Stomata.

5. It is reasonable to explain that the role of photosynthesis is to convert the:

A. Chemical energy produced in **P** to Light Energy released in **Q**.
B. Chemical Energy produced in **Q** to Light Energy released in **P**.
C. Light Energy produced in **Q** to Chemical Energy released in **P**.
D. Light Energy produced in **P** to Chemical Energy released in **Q**.

6. Mammals that live in very cold climates have behavioral adaptations that help reduce the rate at which they lose heat. One example is:

A. decreasing daily food intake.
B. isolating themselves from others.
C. curling up into the shape of a ball.
D. having furs that fluffs out the body.

7. Which organisms directly help reduce overpopulation in a marine community?

A. Predators and prey.
B. Prey and scavengers.
C. Consumers and predators.
D. Decomposers and consumers.
8. Reference to the equation below, which of the following correctly matches the area where the reaction occurs in a mitochondria?

\[
\text{Stored } A(s) + \text{Reactant } B(g) \rightarrow \text{Product } C(g) + \text{Product } D(l) + \text{Stored } E(s)
\]

<table>
<thead>
<tr>
<th>CYTOPLASM</th>
<th>MATRIX</th>
<th>CRISTAE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>A + B</td>
<td>C</td>
</tr>
<tr>
<td>B.</td>
<td>A + B</td>
<td>C + D</td>
</tr>
<tr>
<td>C.</td>
<td>A + E</td>
<td>C + E</td>
</tr>
<tr>
<td>D.</td>
<td>A + E</td>
<td>D</td>
</tr>
</tbody>
</table>

9. Fig 2 shows a section of a DNA molecule.
Which part indicates the ‘nucleotide molecule’?

A. A
B. B
C. C
D. D

10. Numbers I-IV describes a ‘carrier’ that inherits genetic materials in the nucleus of eukaryotic cells.

I. Carries the overall genetic materials.
II. Carries the genetic makeup of a trait.
III. Carries all the four nitrogenous bases.
IV. Carries sections of the genetic materials.

The names for each carrier would be?

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>chromosome</td>
<td>genes</td>
<td>alleles</td>
<td>DNA</td>
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<td>B</td>
<td>chromosome</td>
<td>alleles</td>
<td>genes</td>
<td>DNA</td>
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<td>C</td>
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<td>alleles</td>
<td>genes</td>
<td>chromosome</td>
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<tr>
<td>D</td>
<td>DNA</td>
<td>genes</td>
<td>alleles</td>
<td>chromosome</td>
</tr>
</tbody>
</table>
11. A scientist used a light microscope to examine a range of human cells and the structures they contained. **Fig 3** represents a structure seen in one of the cells.

![Fig 3](image)

The cell is most likely to undergo __________ cell division in _______ cells of human.

A. meiosis - oviduct  
B. mitosis - ovaries  
C. meiosis - testis  
D. mitosis - uterus

12. Black hair color (B) is observed dominant over brown hair color (b) among Tongans. **Fig.4** shows an example of the inherited traits in a Tongan family. The shaded ones represent individuals that contain the ‘b’ trait.

![Fig 4](image)

With respect to the hair color gene locus, it is BEST to comment that individuals __________.

A. **I – 1** is homozygous dominant.  
B. **I – 4** are heterozygous recessive.  
C. **II – 3** are heterozygous dominant.  
D. **III -1** are homozygous recessive.
13. **Fig 5** shows transverse sections of a plant.

![Fig.5](image)

Structures 1 to 6 are BEST represented by which **conducting tissue**?

<table>
<thead>
<tr>
<th></th>
<th><strong>Leaf</strong></th>
<th></th>
<th><strong>Stem</strong></th>
<th></th>
<th><strong>Root</strong></th>
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<tbody>
<tr>
<td></td>
<td>Phloem</td>
<td></td>
<td>Phloem</td>
<td></td>
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<td>Xylem</td>
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<td>Xylem</td>
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<td>Xylem</td>
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<td>3</td>
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<tr>
<td>D</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

14. **Fig 6** below is classified as **herbivorous feeder**.

![Fig.6](image)

Considering the alimentary canal, which statement justifies the organism’s classification?

The presence of ________________.

A. **Q** and **P** where egestion process occurs
B. **S** and **O** where ingestion process occurs
C. **O** and **R** where digestion process occurs
D. **P** and **S** where absorption process occurs
15. When fats and proteins are present in the duodenum, the pancreas and gall bladder take action. **Fig. 7** illustrates the relationship of the organs.

![Fig. 7](image)

It is reasonable to conclude that;

A. signaling molecules carry messages from the duodenum to both gall bladder and pancreas.
B. signaling molecules would diffuse through tissue fluid to fill spaces between different organs
C. an increase in digestive enzymes from the pancreas results in an increase of fats in the duodenum.
D. an increase in bile from the gall bladder increases the breakdown of fats.

16. **Fig. 8** shows two alveoli from the lungs of a smoker A and non-smoker B after *exhalation* is completed.

![Fig 8](image)

The exhalation rate of smoker A is recorded **higher** than that of non-smoker B. This is mainly due to the followings EXCEPT the;

A. absence of alveoli due to part X.
B. presence of X and alveoli structures.
C. damage shown to the capillary vessel X.
D. nicotine release from cigarettes affect X.
17. **Fig. 9** shows the circulatory system (CS) in an organism and the direction of blood flow in the vessels.

![Fig. 9](image)

The circulatory system (CS) in this organism is described to be:

A. open single.
B. open double.
C. closed single.
D. closed double.

18. **Fig. 10** illustrates a section of the nephron structure. Normal functioning of a nephron begins with process 1 - 3 and ends with product 1 & 2.

![Fig. 10](image)

Which of the followings match how the **nephron** section functions?

<table>
<thead>
<tr>
<th>Process 1</th>
<th>Process 2</th>
<th>Process 3</th>
<th>Product 1</th>
<th>Product 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Filtration</td>
<td>Secretion</td>
<td>Urine</td>
<td>Glucose, amino acids, water</td>
</tr>
<tr>
<td>B</td>
<td>Filtration</td>
<td>Secretion</td>
<td>Reabsorption</td>
<td>Urine Glucose, amino acids, water</td>
</tr>
<tr>
<td>C</td>
<td>Secretion</td>
<td>Reabsorption</td>
<td>Glucose, amino acids, water</td>
<td>Urine</td>
</tr>
<tr>
<td>D</td>
<td>Secretion</td>
<td>Filtration</td>
<td>Reabsorption</td>
<td>Glucose, amino acids, water</td>
</tr>
</tbody>
</table>
19. **Fig.11** illustrates the Menstrual Cycle in women.

![Fig 11.](image)

During the infertility periods of the cycle, two hormones are released to stimulate the monthly response of the ovary. They are known as ___________.

<table>
<thead>
<tr>
<th>Day 1-9</th>
<th>Day 21-30</th>
</tr>
</thead>
<tbody>
<tr>
<td>A  Estrogen</td>
<td>Testosterone</td>
</tr>
<tr>
<td>B  Estrogen</td>
<td>Progesterone</td>
</tr>
<tr>
<td>C  Progesterone</td>
<td>Estrogen</td>
</tr>
<tr>
<td>D  Progesterone</td>
<td>Testosterone</td>
</tr>
</tbody>
</table>

20. Which of the followings BEST describes examples of the **Ecological Terms**?

<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>Community</th>
<th>Population</th>
<th>Niche</th>
</tr>
</thead>
<tbody>
<tr>
<td>A  Freshwater shrimps</td>
<td>Freshwater lake</td>
<td>All lake organisms</td>
<td>Pond weed as primary producer</td>
</tr>
<tr>
<td>B  Pond weed as primary producer</td>
<td>Freshwater lake</td>
<td>Freshwater shrimps</td>
<td>All lake organisms</td>
</tr>
<tr>
<td>C  Pond weed as primary producer</td>
<td>All lake organisms</td>
<td>Freshwater shrimps</td>
<td>Freshwater lake</td>
</tr>
<tr>
<td>D  Freshwater lake</td>
<td>All lake organisms</td>
<td>Freshwater shrimps</td>
<td>Pond weed as primary producer</td>
</tr>
</tbody>
</table>
SECTION B SHORT ANSWERS [140 MARKS]

This section consists of SEVEN Questions. Each question is worth 20 marks. ATTEMPT ALL questions in the space provided.

QUESTION ONE [20 MARKS]

1. It is known, that **Enzyme A** (fig.12) acts on a **polypeptide I** to produce **polypeptide II**, a powerful blood pressure ‘normalizing agent’.

   ![Fig 12](image)

   A range of **polypeptide I** (fig. 13) were designed, tested and manufactured. Sample of the molecular shaped of polypeptides are shown as Drug 1, 2 & 3 below.

   ![Fig 13](image)

   a. Out of the three polypeptides, which is the **best drug**?

      Best Drug:

      ____________________________________________________

   ![1 Mark](image)

   b. Describe how the nature of **Enzyme A** function to produce **polypeptide II**.

      Nature of Enzyme A :

      ____________________________________________________

      ____________________________________________________

      ____________________________________________________

      ____________________________________________________

      ____________________________________________________

   ![1 Mark](image)
b. Use the pair of axis in **Fig.14** to answer the following questions:

(i) Sketch the possible **resulting trends** if the following reactions occurred:

a. *Enzyme A vs Best Drug Designed*  
(b. *Best Drug Designed vs Blood Pressure Level*  
(Label trend: A)  
(Label trend: B)

(ii) Explain how the resulting trend labelled ‘B’ may benefit human health.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________

2. The simplified diagram in **Fig 15** below summarizes one type of **reaction** in the photosynthesis process.
a. Indicate the name for this type of ‘reaction’ and explain one reason using evidence from Fig. 15 to why it is classified under this reaction?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

b. Explain how NADPH and ATP are released as products in this phase.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

3. Fig. 16 summarizes the **Cellular Respiration** process.

Fig. 16
a. Considering the names for compound 1 and process 2 in your answer, explain why a split reaction occurs after pyruvate molecules are formed?

_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

b. Reaction 3 leads to Fermentation process.

Write one advantage of such reaction in plants and one disadvantage if occur in animals.

_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

Reaction 4 constantly produces large amount of product 5.

Suggest the name for product 5?

_______________________________________________________________________


d. Describe the importance of producing a large amount of product 5 in the respiration process?

_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
4. **Fig. 17** outlines the production of protein in a cell when structure F is activated.

![Diagram of protein production](image)

**Fig. 17**

a. By stating the names for structures F and G, explain how the process occur from **Stages 1 & 2**.

b. Proteins are produced in **stage 3** with a sequence of amino acids as below.

**Glycine – Arginine – Lysine – Serine**

The table gives possible mRNA codons that codes for each amino acid.

<table>
<thead>
<tr>
<th>Amino Acids</th>
<th>mRNA codons</th>
</tr>
</thead>
<tbody>
<tr>
<td>arginine</td>
<td>UCC or GCG</td>
</tr>
<tr>
<td>glycine</td>
<td>CCA or CCU</td>
</tr>
<tr>
<td>lysine</td>
<td>UUC or UUU</td>
</tr>
<tr>
<td>serine</td>
<td>AGG or UCG</td>
</tr>
</tbody>
</table>

Suppose the mRNA code sequence reads **GGU AGG AAG AGC**.
Write the possible tRNA paired strand coding for the production of protein in stage 3. Include in your answer the role of tRNA anticodons in stage 3.
QUESTION TWO

1. **Fig. 18** illustrates the process of movement of particles in a cell. Substance Y is transported across the membrane as directed by arrows.

![Fig. 18](image1)

a. In terms of ‘Energy and Permeability’, explain how structures A and B facilitate the movement of substance Y across the cell.

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

______________________________________________________________________

b. Similar transport processes occur in **structure B** in the leaf of a plant.

![Fig. 19](image2)
During the hot days in Tonga, the rate of transpiration increases in Fig 19. Explain a reason for this. Use correct terms for A and B in your answer.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

2. Blood cells were placed in three beakers to show the water potentials through osmosis.

![Red Blood Cells](image)

**Fig. 20**

Explain why the water potential differs in **Beaker A and C** as compared to **Beaker B**.

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______________________________________________________________________
______________________________________________________________________
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2 Marks
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<td>0</td>
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</tr>
<tr>
<td>NR</td>
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</tbody>
</table>
3. An experiment was performed to find the effect of surface area to volume ratio on the rate of osmosis. Pieces of yam were cut into cubes of the following sizes:

- Cube A: 2 cm X 2 cm X 2 cm (surface area = 24 cm², volume = 8 cm³)
- Cube B: 1 cm X 1 cm X 1 cm (surface area = 6 cm², volume = 1 cm³)

One Cube A – placed in a Beaker and covered with distilled water. Eight Cube B – placed in another beaker of distilled water, making sure that they were all covered with distilled water.

At intervals for a period of 45 hours, the cubes were removed from the beakers, blotted dry, reweighed and then replaced into fresh distilled water. The results are shown in Fig. 22 below.

In terms of ‘Surface Area (SA) to Volume Size (VS)’, discuss the relationship between SA : VS and the rate of osmosis.

<table>
<thead>
<tr>
<th>3 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
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<td>1</td>
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<td>0</td>
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<tr>
<td>NR</td>
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</tbody>
</table>
4. A Form 6 Biology student set up a light microscope as Fig. 23 below.

The black strip was then replaced with a specimen. The image was seen at first view to be blurry and unresolved.

a. Suggest two reasons for the problem. Your answer should only refer to the named parts in Fig 23.

______________________________________________________________________  
______________________________________________________________________  
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b. After solving the problem the student viewed the specimen again. Fig. 24 illustrates the second image and was labelled Cell A and B.

i. With the use of correct names to numbered structures 1-6, assign two similarities of the viewed specimen.

______________________________________________________________________  
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Fig. 23

![Diagram of a microscope setup]

Fig. 24

![Diagram of cells A and B]
ii. **Organelle 5** are present only in Cell B. Justify two reasons for this.

_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________
_______________________________________________________________________

6. **Fig. 25** illustrates FOUR chromosomes in a pollen cell of a plant. The locus of **3 genes (A B D)** are given.

![Fig. 25](image)

a. Sketch a labelled diagram to show the possible **recombinant genes** if crossing over occur in loci A & D. One example is provided below.

![Diagram](image)

b. Offer two reasons to justify how the outcome of ‘**crossing over**’ may benefit plants.
QUESTION 3 [20 MARKS]

1. The ABO Blood Groups in human is determined by the ABO gene consists of the alleles:

   \( P^A \): A antigen produced, \( P^B \): B antigen produced, \( I \): no antigen produced

One blood type in human is known to be Co- dominant.

   a. Define the term **co-dominant** and state the genotype for this blood group.

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

2. A father who is **Blood Type O** married a woman with **Blood Type A**. He found out later that Sione was not his child. Sione was identified to carry the co-dominant antigens in his blood.

   Draw a punnet square to prove the father is not Sione’s biological father?

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

3. In dogs, two genes have the following alleles

   **Gene 1**: B - black coat colour \( b \) - grey coat colour

   **Gene 2**: T - no spotted white colour \( t \) - white spotted colour
Two dogs, F and G, were mated. The litter of four pups in fig 26 is the resulted phenotypes of the cross.

Use the punnet square below to show the possible genotypes of the puppies, Parent F & G and the phenotypic ratio of the cross.

<p>| | | | |</p>
<table>
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</table>

Phenotypic Ratio: ________________________________

4. **Fig 27** summarizes the steps involved in the production of a cloned sheep.
a. With respect to the cloning production, which Cell (M, N, O) would possibly be identical to Sheep P and why?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

b. Suggest three reasons why Cloning may be of advantage to human?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

2 Marks
2
1
0
NR

3 Marks
3
2
1
0
NR

c. Explain three reasons why Genetic Modified Organism (GMO) Projects may be too risky to human?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

3 Marks
3
2
1
0
NR
5. The following graph shows the changes in biomass (dry weight) of two species of clover grown together in equal numbers in the same plot. Equal numbers of each species germinated.

![Graph showing biomass changes](image)

**Fig. 28**

a. Explain how the plotted trends support “Gause’s Principle”.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

b. Suppose the two clover species experienced a drought season. How may it affect the relationship of the clover species?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

2 Marks

<table>
<thead>
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1 Mark

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</tbody>
</table>
QUESTION FOUR [20 MARKS]

1. **Fig. 29** represents a transverse section of the root of a plant.

a. Explain two purposes of the soil water in plants.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

b. In terms of ‘structural adaptation’, explain how structure A assist the uptake of soil water in plants. Include in your answer the name of structure A.

____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________
____________________________________________________________________________

(c. Suppose the whole plant is soaked in a beaker of water as Fig 30.

[Diagram of plant with roots]
Explain how soil water is transported in the plant from B to C.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

2. Another set up is shown in **fig. 31** using a potometer.

![Fig 31](image)

a. The set-up investigated the rate of water uptake of a cut leafy twig under six different conditions. The students changed two environmental conditions around the plant, temperature & wind speed.

   For each experiment, the apparatus was left in the conditions until the rate of water uptake by the leafy shoot became constant.

   Several measurements were taken during each experiment and calculated the mean rate movement of the gas bubble.
The results are recorded in the table below:

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Temperature / °C</th>
<th>Wind Speed</th>
<th>Mean Rate of Movement of gas bubble / mmh⁻¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>Low</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>High</td>
<td>22</td>
</tr>
<tr>
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<td>Low</td>
<td>24</td>
</tr>
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<td>25</td>
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<td>120</td>
</tr>
</tbody>
</table>

a. Explain the purpose of using a potometer and a cut leafy twig in this experiment.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

b. From the data recorded, explain how the changes of conditions affect the rate of water uptake.

Temperature:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Wind:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
c. The rate of water movement up the leafy shoot was measured before it was cut from the plant. The rate was found to be less than the rate of water uptake from the potometer.

Explain why the rate of water uptake in an intact shoot is less than that measured in the potometer.

________________________________________________________________________
________________________________________________________________________
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2 Marks
2
1
0
NR

3. **Fig. 32** illustrates the alternative generation growth in plants.

![Alternative Generation Growth Diagram](image)

a. In terms of *gametophyte* and *sporophyte*, explain where along the life cycle of Plant 1 and 2 and LETTER S, T, U and V does the two alternative generation process occur.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
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2 Marks
2
1
0
NR
b. Suppose Plant 1 is a *hibiscus plant*, name the type of reproduction that is involved in this life cycle and explain one advantage and disadvantage it is to the cycle.
1. Tonga has been recorded to be the world's most overweight nations. It is argued in the record that 88.3% of Tongan women and 83.5% of Tongan men over the age of 20 are overweight and 52.6% of Tongan girls and 34.5% of Tongan boys under the age of 20 are also overweight.

One possible causal factor is the influence of Meal A in Fig 33.a.

Fig.33.a MEAL A Fig.33.b Ingredient B

a. Explain THREE reasons why the collective data can be ‘true’ for Tongans?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

b. Meal A is interpreted as the ‘yummy meal’ as compared to a ‘yucky dish’ made with ingredient B. Clearly explain why this can be misleading to children.

Meal A : Yummy Meal:

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

3 Marks
3
2
1
0
NR

2 Marks
2
1
0
NR
31

**Ingredient B makes a Yucky Dish:**

2. The incline below illustrates the level of insulin and glucagon in the human body.

   ![Fig. 34](image)

   **Fig. 34**

   a. With reference to Fig. 34, what does it say about the level of sugar in the body?

   _____________________________________________________________
   _____________________________________________________________
   _____________________________________________________________

   b. Explain how homeostasis controls the blood sugar level stated in ‘a’ above.

   _____________________________________________________________
   _____________________________________________________________
   _____________________________________________________________
   _____________________________________________________________
   _____________________________________________________________
   _____________________________________________________________

   ![Table](image)
3. Fig. 35 illustrates a villus which assist the digestive system in human.

Fig. 35

a. Considering structures **H and I**, describe its role in the villus of human.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

b. Explain two adaptive features of a villus that supports its role in the digestive system.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

4. The graph below shows three enzyme activities as related to different pH level in the human body.

Fig. 36

![Graph showing enzyme activities](image-url)
a. Reference to the enzymes plotted, SELECT ONE activity and explain how different pH Levels affect the rate of activity. Include in your discussion the area where the enzyme activity is operated.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

4. The ‘NORM’ interaction for life-term survival in an Ecosystem is illustrated in Fig. 37 below.

[Diagram of an ecosystem with a food chain]

Fig 37.

a. Examine Fig 37 and explain using names the possible type of interaction occurring in the food chain.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
b. In terms of energy, which organism would obtain the highest energy level and why?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

QUESTION 6

1. **Fig. 38** illustrates Dichotomous key for the following species.

1. How many pairs of wings present?
   a. One pair of wings  
      Go to 2
   b. Two pair of wings  
      Go to 3

2. Does the insect have filaments at the end of abdomen?
   a. Yes  
      Ephemeroptera
   b. No  
      Diptera

3. Is the forewing ________?
   a. Hard  
      Go to 4
   b. Not hard  
      Go to 5

4. Does the insect have forceps (or pinchers) on its abdomen?
   a. Yes  
      Dermoptera
   b. No  
      Coleoptera

5. Is the forewing ________?
   a. Membranous  
      Odonata
   b. Covered with scales  
      Lepidoptera
a. Using the key provided, suggest the names for Organism M and O
Organism M:
_____________________________________________________________________
Organism O:
_____________________________________________________________________

b. Suppose another Choice # 6 is added to this Dichotomous Key.
By using Organism N as an example, suggest two possible descriptions
to Choice # 6.
_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

2. Fish consists of a special gas exchange system known as the
Concurrent System. Fig.39 illustrates this system.

![Fig.39](image)

a. Give the names for the composition of blood flowing in arrow 1 & 2.

Blood 1: ____________________________________________
Blood 2: ____________________________________________
b. Explain the efficiency of this concurrent system to fish. Focus your answer in the direction of water flow and blood flow and the adaptation of gills.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

3. **Fig 40** below shows the cardiac cycle of an amphibian.

![Amphibian Cardiac Cycle](image)

a. Comparing amphibian’s cardiac cycle to human, explain two reasons how they differ.

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

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<tbody>
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<td>1</td>
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<tr>
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<tr>
<td>NR</td>
</tr>
</tbody>
</table>
b. Considering the role of ventricle, explain how blood is circulated in this cardiac cycle?

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

4. Tonga’s Ministry of Health reported that one cause of death in Tonga is the high rate of Non-Communicable Disease (NCD). Evidence of high rate cause the shift from a normal artery to blockage of heart vessel in Fig 41.

Fig. 41

Normal Artery

Normal blood flow

Atherosclerosis Artery

Plaque narrow Artery
Obstacle to Blood Flow

Suggest THREE counselling advice you may offer to save Tonga and why.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
5. An ecosystem consists of **Groups A - D** of organisms as below.

<table>
<thead>
<tr>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>Group D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algae</td>
<td>Caterpillars</td>
<td>Chicken</td>
<td>Soil bacteria</td>
</tr>
<tr>
<td>Mosses</td>
<td>Moths</td>
<td>Birds</td>
<td>Molds</td>
</tr>
<tr>
<td>Ferns</td>
<td>Worms</td>
<td></td>
<td>Mushrooms</td>
</tr>
<tr>
<td>Pine trees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oak trees</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. Illustrate with examples from the table a representative of an Energy Pyramid.

________________________

________________________

________________________

________________________

________________________

________________________

________________________

________________________

2 Marks

| 2 | 1 | 0 | NR |

b. **Group 4** are ‘specialists’ in the environment. By giving the appropriate biological term for **Group 4**, explain its relationship to ‘biodiversity and ecosystem’.

________________________

________________________

________________________

________________________

________________________

________________________

________________________

2 Marks

| 2 | 1 | 0 | NR |
1. **Fig. 42** illustrates the nitrogenous wastes excreted by animals 1 - 3. Use the diagram to answer the following questions.

   ![Diagram](image)

   **a.** Give the names of the nitrogenous waste excreted in Animal 1, 2 & 3.

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________

   **b.** By defining osmoregulation, explain how the process would regulate in freshwater fish and marine fish.

   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
   __________________________________________________________
c. Sione was diagnosed to have ‘GOUT’ by you the family doctor.

Simply explain the cause of his gout and suggest TWO advice of what he should do to reduce the pain he’s feeling due to gout.

______________________________________________________________________
______________________________________________________________________
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2. Fig. 43 illustrates a section of the female reproductive organ.

![Female Reproductive Organ Diagram]

a. Explain using appropriate names the processes occurring in Stages 1, 2 & 3.

______________________________________________________________________
______________________________________________________________________
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______________________________________________________________________

3 Marks

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<tr>
<th>3</th>
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<th>1</th>
<th>0</th>
<th>NR</th>
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</thead>
</table>
2. **Fig. 44** illustrates the relationship between two living beings (mother and baby).

![Diagram of blood flow](image)

**Fig. 44**

a. Explain the importance of structures **M and N** for the development of the foetus.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

b. Explain how the substances in structure N- Blue and N – Red contributes to the development of the foetus.

______________________________________________________________________
______________________________________________________________________
______________________________________________________________________
______________________________________________________________________

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<td>0</td>
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<tr>
<td>NR</td>
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</tr>
</tbody>
</table>
3. There are two varieties of lice which live mainly on human skin and hair.

**Fig. 45** illustrates the two lice with evidence of belonging to the same ancestors.

![Image of two lice - A: Head louse, B: Body louse](image)

**A : Head louse**
*Pediculus humanus capitis*

**B : Body louse**
*Pediculus humanus corporis*

---

a. To which phylum does the two lice belong to?

[Student's response]

---

b. Justify your answer in ‘a’ with evidence from **Fig.45**.

[Student's response]

---

c. With reference to **Fig.45**, select ONE organism and explain TWO adaptive features that may help the organism survive in human hair.

[Student's response]

---
SECTION C: EXTENDED RESPONSE QUESTIONS  [20 MARKS]

This section consists of TWO compulsory questions. Each question is worth 10 marks. Answer Section C in the spaces provided.

Marks will be given to answers that show clear, accurate expressions of ideas in a logical and cohesive manner. Marking criteria is provided at the end of the questions.

QUESTION 1:  [10 marks]

An experiment was set up by Form 6 Biology students out at the backyard of their school.

The following table in Fig. 46 below shows the study area and the species distributed in the field.

![Fig. 46]

Quadrat size  = 1m²
Total size of area  = 100 m²

Formula:
Population Size  = \( \frac{P = \text{Total Area} \times \text{Total Sample}}{\text{Area of Quadrat}} \)

With reference to the above information, **WRITE** a formal lab report of this experiment. **USE** the guidelines provided in the marking criteria *(refer to page 45)* to assist your discussion in this question.
<table>
<thead>
<tr>
<th>Name</th>
<th>Quadrat 1.3</th>
<th>Quadrat 2.5</th>
<th>Quadrat 3.1</th>
<th>Quadrat 4.2</th>
<th>Quadrat 5.4</th>
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<tbody>
<tr>
<td>Daisy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dandelion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plantain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buttercup</td>
<td></td>
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<tr>
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<th>Mark Allocated</th>
<th>Marks Awarded</th>
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<tr>
<td>Aim</td>
<td>1 mark</td>
<td></td>
</tr>
<tr>
<td>Method</td>
<td>2 marks</td>
<td></td>
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<tr>
<td>( at least four steps listed )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completion of Table</td>
<td>2 marks</td>
<td></td>
</tr>
<tr>
<td>( 2 marks for accuracy of all rows )</td>
<td></td>
<td></td>
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<tr>
<td>Correct Calculation of Population Size</td>
<td>2 marks</td>
<td></td>
</tr>
<tr>
<td>Complete conclusion</td>
<td>3 marks</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>10 marks</strong></td>
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</table>
QUESTION 2

[10 marks]

Compare the role of mitosis and meiosis in the life cycle of an organism and sketch a concept map to show the flow of the process in human.
<table>
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<tr>
<th>Criteria</th>
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<th>Mark Awarded</th>
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<tbody>
<tr>
<td>Define the role of Mitosis and Meiosis</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Where cells are they found with supportive Examples.</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Include a <strong>concept map</strong> is to show the flow of N and 2N chromosomes occur in human</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Comparison of the two Process in relation to:</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>- Number of chromosomes in parent cell</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>- Number of chromosome in meiosis &amp; mitosis cell division</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>- Number of chromosomes after fertilization &amp; after birth of baby</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>- Number of daughter cells</td>
<td>1</td>
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<tr>
<td><strong>Total</strong></td>
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ANSWER SHEET
WRITE THE LETTER OF THE CORRECT ANSWER ONLY.

MULTIPLE CHOICE ANSWER BOXES FOR OFFICIAL ONLY

BIOLOGY 2015: SECTION TOTALS

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2 \times \boxed{200} = \boxed{400}