

**BIOLOGY II**

**012**

**14/11/2019**

**8:30 AM – 11:30 AM**



**Rwanda Education Board**

**ADVANCED LEVEL NATIONAL EXAMINATIONS, 2019**

**SUBJECT: BIOLOGY**

**PAPER II: THEORY**

**COMBINATIONS:**

- BIOLOGY-CHEMISTRY-GEOGRAPHY (BCG)**
- MATHEMATICS-CHEMISTRY-BIOLOGY (MCB)**
- PHYSICS-CHEMISTRY-BIOLOGY (PCB)**

**DURATION: 3 HOURS**

**INSTRUCTIONS:**

- 1) Write your names and index number on the answer booklet as written on your registration form and **DO NOT** write your names and index number on additional answer sheets of paper if provided.
- 2) Do not open this question paper until you are told to do so.
- 3) This paper consists of two sections: **A** and **B**.
  - SECTION A:** Attempt all questions. **(70marks)**
  - SECTION B:** Attempt any **THREE** questions. **(30marks)**
- 4) Use only a **blue** or **black** pen.

**SECTION A: ATTEMPT ALL QUESTIONS. (70 marks)**

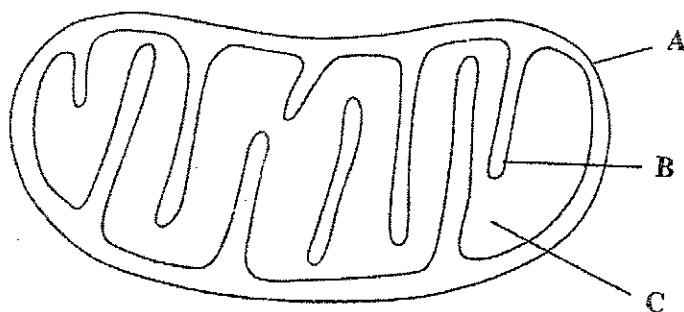
1) a) Describe the difference between Fungi and Plants. **(2 marks)**

b) Explain why a spider is not an insect. **(2 marks)**

2) Draw a table to compare the Prokaryotes and the Protoctists. **(5 marks)**

3) Mitochondria are sites of cellular respiration in which carbon dioxide and water are produced.

The diagram below shows the structure of a Mitochondrion.



a) Use the labels on the diagram then identify where the following substances are produced:

i) Carbon dioxide **(1mark)**

ii) Water **(1mark)**

b) Explain why muscle cells contain large numbers of Mitochondria. **(2 marks)**

- 4) Starch, Glycogen and cellulose are all polysaccharides. They are made from Monomers that are joined by covalent bonds.  
Copy and complete the table below to show which of the statements apply to each of the polysaccharides.  
Fill in each box using a tick (✓) to show that the statement applies and a cross (X) if it does not.

Statement	Starch	Glycogen	Cellulose
Glycosidic bonds between monomers			
Monomer is $\beta$ -glucose			
Stored within chloroplasts			
Stored in Muscle cells			
Exist in two forms; branched and unbranched			

**(5 marks)**

- 5) A solution of Enzyme Amylase was added to a solution of starch then this mixture was kept at 25°C. The starch was broken down by hydrolysis.

Explain how you would determine the rate of hydrolysis.

**(4 marks)**

- 6) Water is sometimes described as a substance that provides an ideal environment for many organisms.

Explain how the Hydrogen bonds between water molecules affect the properties of water and help to make water an ideal environment for many organisms.

**(5 marks)**

- 7) a) Explain why the mammalian Circulatory System is described as a closed double circulation.

**(2 marks)**

- b) Mature mammalian Red blood cells have no Nucleus.

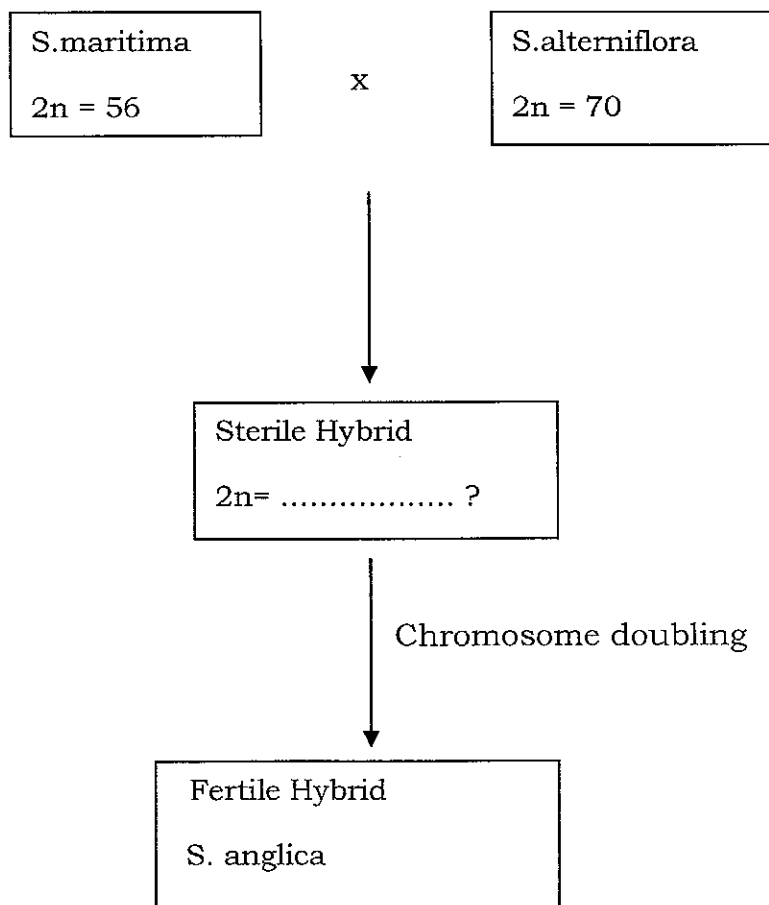
State one advantage and one disadvantage of the absence of nuclei in mammalian red blood cells.

**(2 marks)**

c) Explain how the heart is coordinated so that the ventricle contracts after the atrium has contracted.

**(4 marks)**

- 8) Spalina Anglica is a species of grass which has originated as a result of the formation of a Hybrid between two related species. *S.maritima* and *S.alterniflora*, as shown in the diagram below. The diploid numbers of chromosomes for *S. maritima* and *S. alterniflora* are given in the boxes.



- a) (i) Give the expected diploid number ( $2n$ ) of chromosomes for the sterile Hybrid.

**(1 mark)**

- (ii) Explain why this hybrid is sterile.

**(2 marks)**

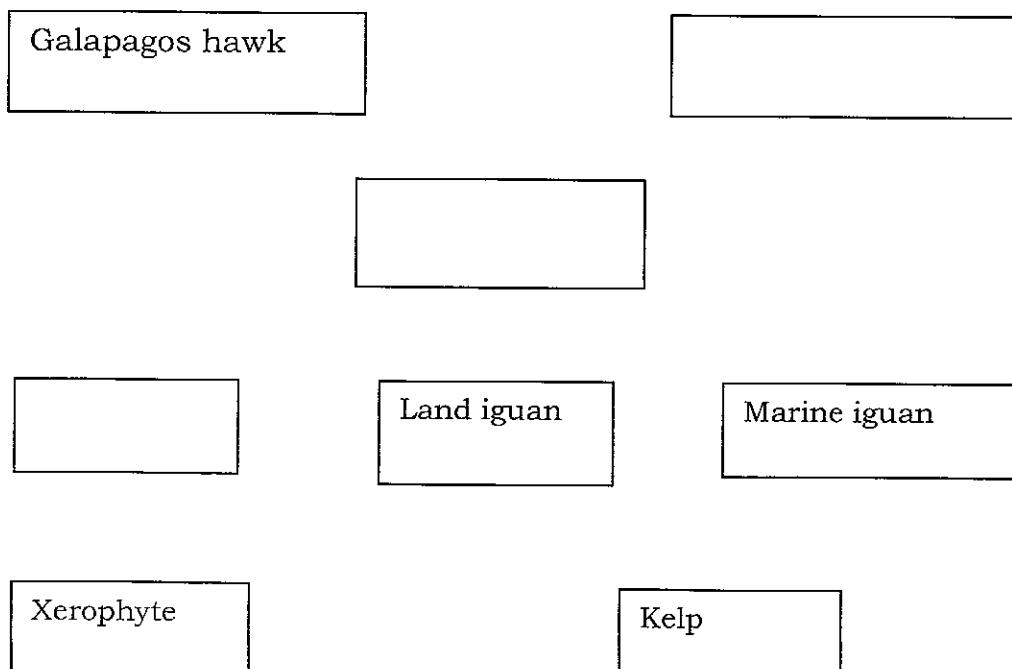
- b) Suggest how doubling of chromosomes may have occurred to produce *S.anglica*.

**(3 marks)**

- 9) When investigating ecosystems, food chains and food webs are constructed. Read the passage below about trophic relationships on one of the Galapagos Islands.

Marine Iguans Feed on Kelp, which grows attached to rocks in shallow waters. Kelp is a photosynthetic organism. Further inland, Xerophytes are grazed upon by land Iguans. A great diversity of Herbivorous Insects, including many species of short-horned grasshoppers, feed on the Xerophytes. An analysis of the gut content of Lava Lizards reveals that these insects are prey for the lizards. The Lizards are preyed upon by Snakes. The snakes also hunt grasshoppers and newly hatched iguans. The Galapagos hawk has a varied diet and catches animals such as snakes, short horned grasshoppers, small lava lizards and newly hatched iguans.

- a) Copy and complete the Figure below to make a Food web by:
- Filling in the blank boxes with names of the organisms.
  - Adding arrows to show the direction of energy flow between all the different links in the Food web.



**(4 marks)**

b) State which organisms in the figure are the producers.

Explain your choice.

**(3 marks)**

10) a) Some bacteria such as Rhizobium, carry out nitrogen fixation, which is an important process in the nitrogen cycle.

Explain what is meant by the term: "Nitrogen fixation".

**(3 marks)**

b) An important enzyme in the nitrogen cycle is Urease, which catalyses the hydrolysis of Urea to ammonia.

The reaction equation is shown below.



i) State the name of the process in the nitrogen cycle.

**(1 mark)**

ii) Explain the importance of this process in making nitrogen from animals to be available for uptake by plants.

**(2 marks)**

11) a) Explain why large, active organisms need special surface area for exchange with the environment.

**(4 marks)**

b) Explain why the barrier to diffusion must be as thin as possible.

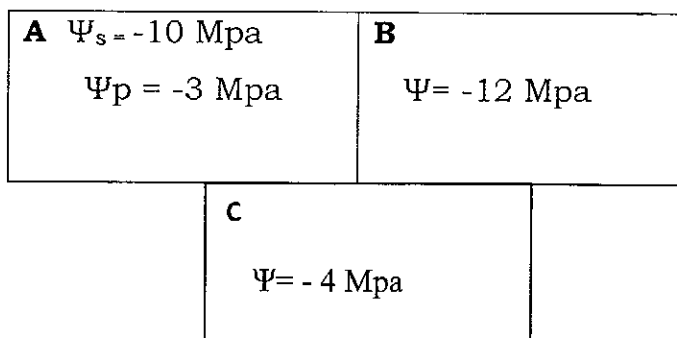
**(2 marks)**

12) Mitochondria and chloroplasts contain small loops of DNA. They also contain ribosomes that are the same size as prokaryotic ribosomes.

Suggest an explanation for these features.

**(3 marks)**

13) The diagram shows three adjacent plant cells.



- a) Calculate the water potential of Cell A. **(1 mark)**
- b) Copy the diagram and show by means of arrows, the direction of water movement between these cells. **(1 mark)**
- c) Explain why water potential of a sucrose solution has a negative value. **(2 marks)**

14) Sertoli cells contain abundant smooth endoplasmic reticulum, Golgi apparatus, and many Mitochondria and Lysosomes. In view of the structure of these cells, what can you suggest about their functions? **(3 marks)**

### **SECTION B: ATTEMPT ANY THREE QUESTIONS (30 marks)**

- 15) a) What are functions of the autonomic nervous system in man? **(6 marks)**  
 b) In what ways is the autonomic nervous system similar to the endocrine system? **(4 marks)**
- 16) Describe how carbon dioxide is removed from the mammalian tissues into the atmosphere. **(10 marks)**
- 17) The Mammalian Oestrous cycle is controlled by hormones secreted from pituitary glands and ovaries. Describe the roles of the following hormones in the control of this cycle.
  - a) The pituitary Hormones FSH and LH **(5 marks)**
  - b) The Ovarian hormones, Oestrogen and Progesterone. **(5 marks)**

- 18) Write an account of the cell cycle, involving Mitotic nuclear division, highlighting the events occurring in each phase. **(10 marks)**
- 19 a) What is meant by Biodiversity? **(3 marks)**  
b) Discuss why it is important to maintain biodiversity? **(7 marks)**