Rwanda National Biology II S6 Collection (2003 - 2023)

BIOLOGY-CHEMISTRY-GEOGRAPHY (BCG)

- MATHEMATICS-CHEMISTRY-BIOLOGY (MCB)

- PHYSICS-CHEMISTRY-BIOLOGY (PCB)

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Biology II

012

27/07/2023 08:30 AM – 11:30 AM

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2022-2023

SUBJECT: BIOLOGY II

PAPER II: THEORY

COMBINATIONS:

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

DURATION: 3 HOURS

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   SECTION B: Attempt only **THREE** questions. **(30 marks)**
4) Use only a **blue** or **black** pen.

Section A: Attempt all Questions. (70 marks)

1) Identity the following kingdoms:

i) No nuclear membrane bound mitochondria. **(1 mark)**

ii) Organelles surrounded by membrane found inside thread like hyphae. **(1 mark)**

iii) The Organelles are either unicellular or multicellular and contain organelles with membrane. **(1 mark)**

iv) Multicellular organisms have autotrophic nutrition. **(1 mark)**

v) Multicellular organisms have heterotrophic nutrition. **(1 mark)**

2) a) Ribosomes are important in which process? **(1 mark)**

b) In each of the following, name the organelle which is being referred to.

i) Powerhouse of the cell. **(1 mark)**

ii) Contains chromatin. **(1 mark)**

iii) Synthesizes glycoproteins. **(1 mark)**

3) Name the chemical reagents which are used in the laboratory to test for the presence of each of the following food substances:

i) Starch. **(1 mark)**

ii) Reducing sugars. **(1 mark)**

iii) Non- reducing sugars. **(1 mark)**

iv) Vitamin C (Ascorbic acid). **(1 mark)**

4) Explain how guard cells are adapted for stomatal opening and closure. **(3 marks)**

5) State four functions of the vertebrate's skeleton. **(4 marks)**

6) a) Define diffusion. **(1 mark)**

b) List the factors that affect the rate of diffusion of a molecule into a cell. **(3 marks)**

7) Distinguish between the following terms: centrosome, centriole and centromere. **(3marks)**

8) Explain how a change in DNA sequence would result in production of non-functional protein. **(3 marks)**

9) Distinguish between:

a) Cyclic and non-cyclic photophosphorylation. **(2 marks)**

b) Photophosphorylation and oxidative phosphorylation. **(2 marks)**

c) The roles of NAD and NADP in a plant. **(2 marks)**

10) a) Give the differences between complete and incomplete metamorphosis. **(2 marks)**

b) What is the benefit of metamorphosis to insects? **(1 mark)**

11) With reference to endocrine and nervous system, identify the role played by feedback mechanism in homeostasis. **(3 marks)**

12) At the end of a sprint race, a runner continues to breathe rapidly for some time. Evaluate the advantage of this. **(3 marks)**

13) Differentiate between grafting and cutting. Provide an example for each method. **(3 marks)**

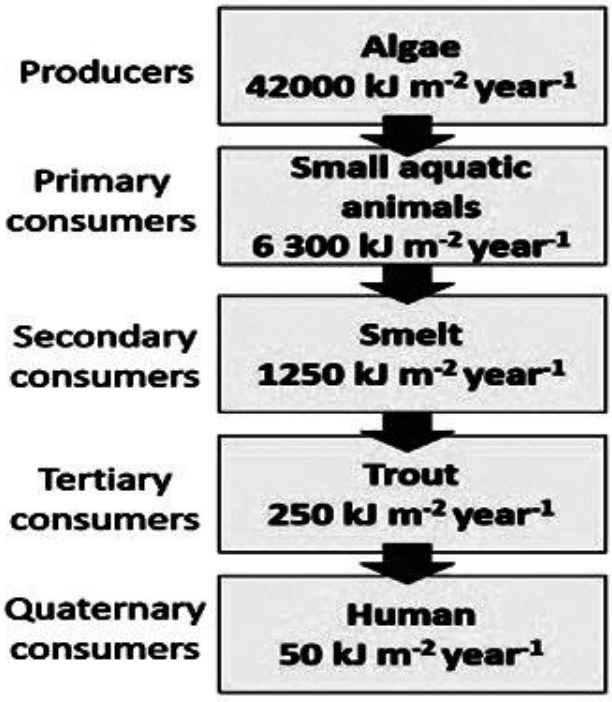
14) Construct a table that compares sperm and ovum. **(4 marks)**

15) Bacteria maintain the balance in the environment. Justify this statement. **(3 marks)**

16) Classify the following variations as either caused entirely by genetic effects or caused by a combination of genetic and environmental effects:

i) Obesity **(0.5 marks)**
ii) Eye colour **(0.5 marks)**
iii) Tallness **(0.5 marks)**
iv) Ability to sing **(0.5 marks)**
v) Maleness **(0.5 marks)**
vi) Masculinity **(0.5 marks)**
vii) Blood group **(0.5 marks)**
viii) Natural hair color **(0.5 marks)**
ix) Sickle-cell anaemia **(0.5 marks)**
x) Agility **(0.5 marks)**

17) Consider the food chain in Kivu Lake.



Calculate the percentage efficiency of the transfer of energy between:

a) Primary consumers and secondary consumers. **(2 marks)**
b) Tertiary consumers and quaternary consumers. **(2 marks)**
c) Producers and quaternary consumers. **(2 marks)**

18) Define the following terms:

a) Biotechnology. **(2 marks)**
b) Genetic engineering. **(2 marks)**

Section B: Attempt Any Three Questions (30 marks)

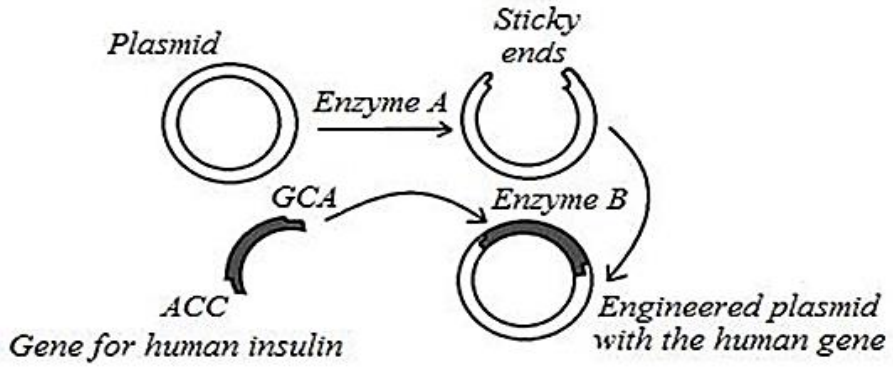
19) A plant with hairy stems and yellow flowers was crossed with a plant hairy stems and white flowers. Yellow flower colour is dominant over white. Seeds from F1 were sown and plants with the following characteristics were obtained:
28 plants with hairy stems and yellow flowers.
35 plants with hairy stems and white flowers.
10 plants with smooth stems and yellow flowers.
11 plants with smooth stems and white flowers.
   a) Which is dominant Hairy stems or smooth stems? Why? **(2 marks)**
   b) What is the genotype of parents? **(2 marks)**
   c) Draw the genetic cross to show the genotype and phenotypes of F1 plants. **(4 marks)**
   d) What is the ratio of hairy stem to smooth stems? **(1 mark)**
   e) What is the ratio of yellow to white flower? **(1 mark)**

20) Make a list of different causes of evolution and write short summary in your own words on the meaning of each cause**.** **(10 marks)**

21) a) What is meant by:
   i) Greenhouse effect? **(1 mark)**
   ii) Eutrophication? **(1 mark)**
   b) Explain how human activities have contributed to the increased greenhouse effect. **(4 marks)**
   c) Suggest practical remedies to the greenhouse problem. **(4 marks)**

22) Compare blood, tissue fluid and lymph. **(10 marks)**

23) The diagram below shows the stages in the insertion of the gene for insulin into a bacterium.



   a) Name the substance that makes up the plasmid. **(1 mark)**
   b) Identify the enzyme labelled **A.** What is its role? **(2 marks)**
   c) Identify the sticky ends of the plasmids that are complementary to those shown on the gene. **(2 marks)**
   d) Identify enzyme **B** on the diagram. What is its role? **(2 marks)**
   e) What term is given to a length of DNA formed from different sources? **(1 mark)**
   f) How is the plasmid inserted into the bacterium? **(1mark)**
   g) How do scientists identify the bacteria which have taken the plasmid? **(1 mark)**

-END-

Biology II

012

28/07/2022 08:30 AM – 11:30 AM

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2021-2022

SUBJECT: BIOLOGY II

PAPER II: THEORY

COMBINATIONS:

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

DURATION: 3 HOURS

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4) Use only a **blue** or **black** pen.

SECTION A: ATTEMPT ALL QUESTIONS (70 marks)

1) a) Which eucaryotic kingdoms contain:

i) Autotrophic organisms? **(1 mark)**

ii) Heterotrophic organisms? **(1 mark)**

b) Classify each of the following organisms: cockroach, honeybee and maize under the following taxa, kingdom, phylum and class. **(3 marks)**

2) a) What is the importance of plasma membrane in active transport? **(1 mark)**

b) Apart from controlling the movement of materials out of cells, state another function of cell membrane. **(1 mark)**

c) During mitosis in a certain animal, chromatids failed to separate and move to opposite poles.

i) Name the organelle that the cell was lacking. **(1 mark)**

ii) State the function of the named organelle in (i) above. **(1 mark**

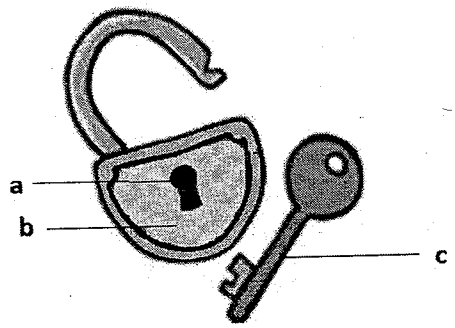
3) Design a table to show how you can test for food substance suspected to contain a protein, indicating procedure, observations, and conclusion. **(3 marks)**

4) a) Distinguish between **amylopectin** and **amylose** **(2 marks)**

b) What is the universal solvent in living organisms? **(1 mark)**

5) a) What is meant by "turn over number of an enzyme"? **(1 mark)**

b) The diagram below represents Rock and Key hypothesis



Match letters in column **1** with appropriate terms in column **2**.

Column 1	**Column 2**
a	Substrate
b	Active site
c	Enzyme

(3 marks)

c) Enzyme $\rightleftharpoons$ Enzyme + Product.

From this equation, name two properties of enzyme shown. **(2 marks)**

6) Contrast the following:

i) Cyclic and non-cyclic photophosphorylation. **(2 marks)**

ii) Photophosphorylation and oxidative phosphorylation. **(2 marks)**

7) a) i) Define the term translocation. **(1 mark)**

ii) What is the importance of translocation in the life of a plant?

(2 marks)

b) Transpiration has sometimes been described as a "necessary evil". Justify this statement. **(4 marks)**

8) a) A dog weighing 18kg requires 226 KJ while a mouse weighing 50 g requires 2010 KJ per day. Explain. **(3 marks)**

b) Name the end products of anaerobic respiration in :

i) Plants **(1 mark)**

ii) Animals **(1 mark)**

c) Give two reasons why obligate anaerobes die in the presence of oxygen. **(1 mark)**

9) Assess any five applications of anaerobic respiration. **(5 marks)**

10) a) Sinoatrial node is called pacemaker. Justify this statement. **(2 marks)**

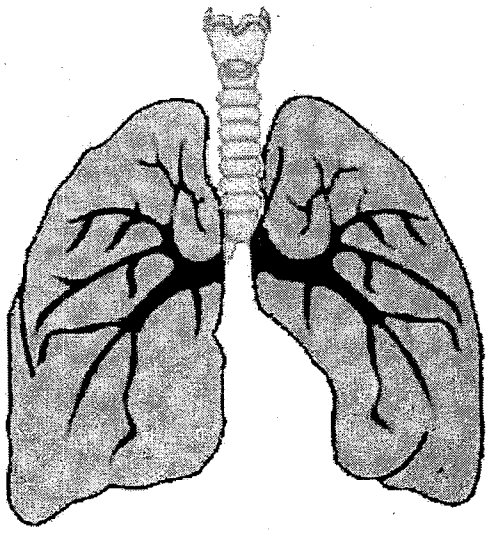
b) Explain why the atrial fibrillation decreases the efficiency of the heart. **(3 marks)**

11) a) Why do animals need to move from one place to another? **(2 marks)**

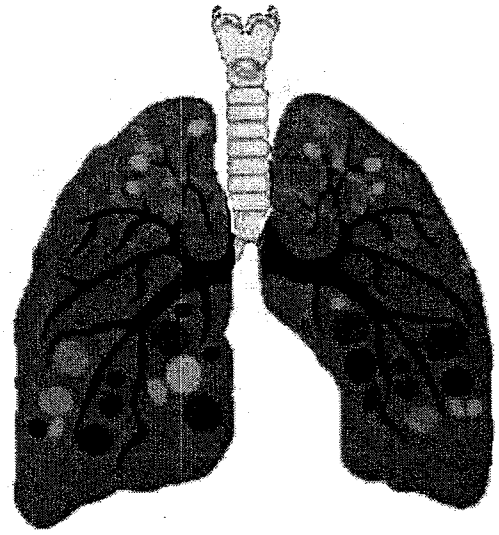
b) What are the three types of skeletons in animals? **(3 marks)**

12) Explain the role of behavioural rhythms? **(4 marks)**

13) Study the pictures below (**A**) and (**B**) that represent lungs and then answer the questions that follow.



(A)



(B)

(a) Which of these lungs (**A**) or (**B**) is healthier? **(1 mark)**

(b) How is it different from the other one? **(1 mark)**

14) Would fertilization take place if copulation takes place two days before ovulation? Give a reason for your answer. **(2 marks)**

15) Low blood sugar level is harmful to the body. Explain this statement. **(2 marks)**

16) The sun is the main source of energy in many ecosystems. Name an alternative source of energy in other ecosystems. **(2 marks)**

17) Is it possible for colour-blind girl to be born? Explain. **(2 marks)**

18) Rearrange the order of the following statements to give a flow diagram showing the evolution of resistance to the antibiotic streptomycin by the bacterium Escherchia Coli (E.Coli).

a) Most of the population of E.Coli are resistant to streptomycin

b) A mutation in a DNA triplet of a plasmid, changing TTT to TTG, gives an E.Coli bacterium resistance to streptomycin

c) The resistant bacterium divides and passes copies of R plasmid (plasmid with gene for resistance to antibiotic) to its offsprings.

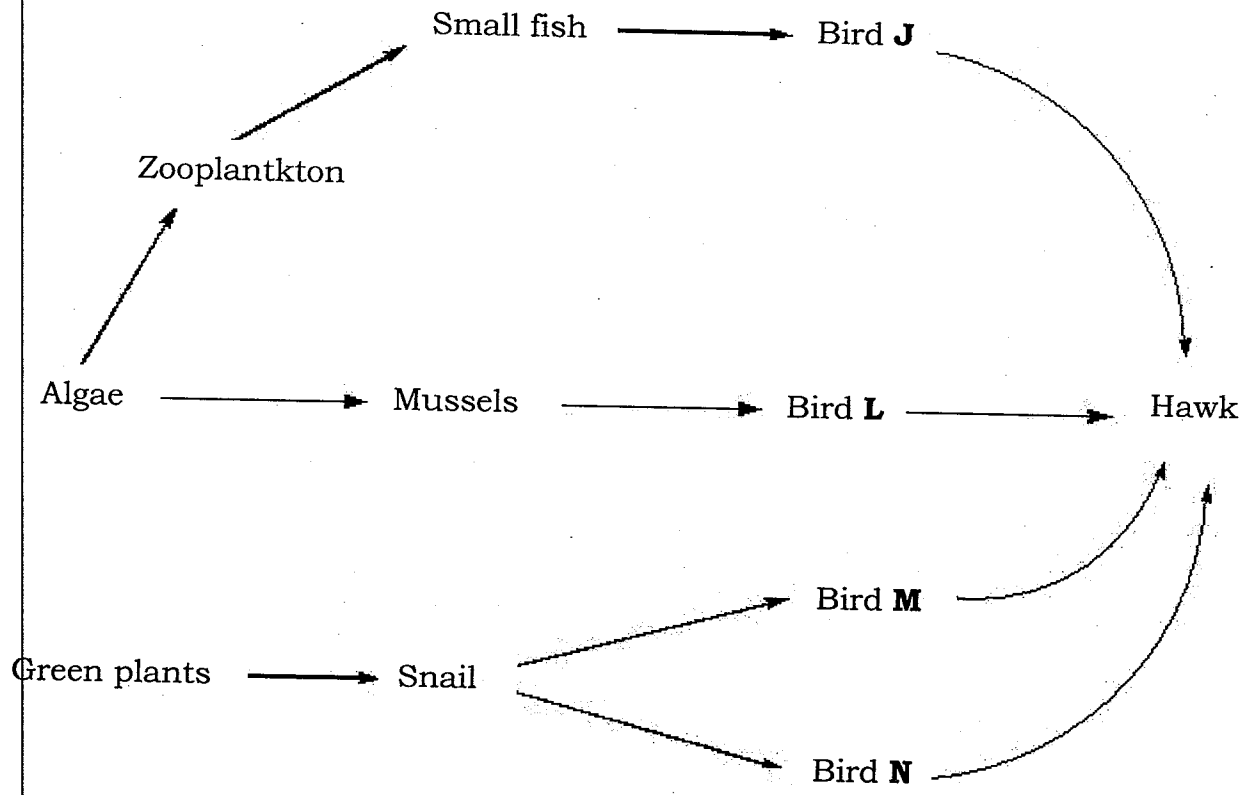
d) Sensitive bacteria die in the presence of streptomycin as a selective agent.

e) The frequency of the mutated gene in the population increases.

f) The resistant bacterium has a selective advantage and survives. **(3 marks)**

SECTION B: ATTEMPT ANY THREE QUESTIONS (30 marks)

19) Some students went for an ecological study and constructed the food web below.



a) Name the process through which energy from the sun is included into the food web. **(1 mark)**

b) Name the mode of feeding of bird **M** in the food web. **(1 mark)**

c) Name Two ecosystems in which the organisms in the food web live.
(2 marks)

d) From the food web, construct a food chain in which the Hawk is the quaternary consumer.
(2 marks)

e) If bird **N** migrated, what would happen to the organisms in the food web?
(4 marks)

20) a) What is homeostasis?
(2 marks)

b) Discuss the homeostatic functions of the liver.
(8 marks)

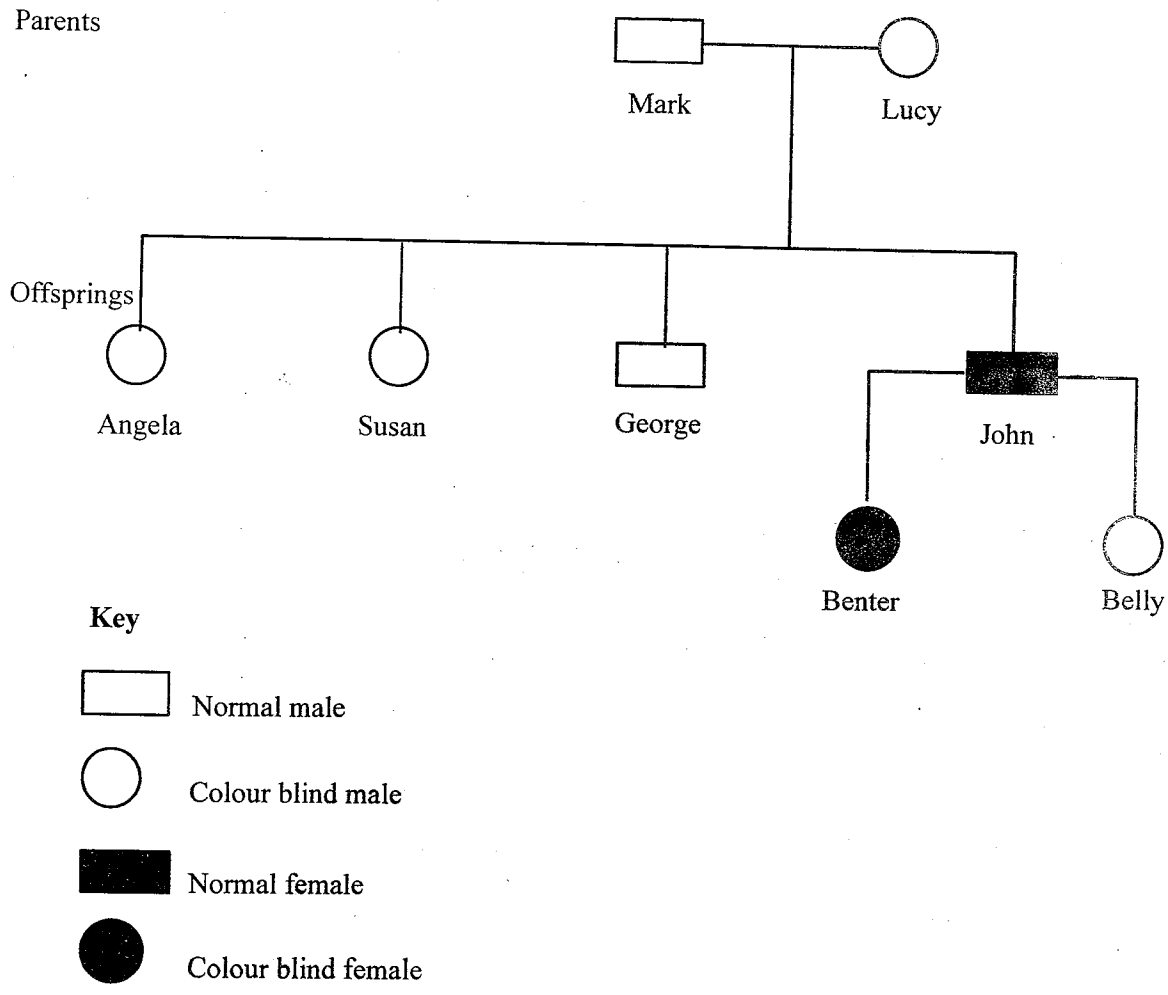
21) Give your personal views on the economic importance of Kingdom Fungi.
(10 marks)

22) Explain how the various activities of human beings have affected their environment negatively.
(10 marks)

23) a) What is meant by sex-linkage? **(2 marks)**

b) Colour-blind is a sex-linked disorder in human. The gene responsible for the disorder is recessive and is located on the X-Chromosome.

Below is a pedigree chart showing the inheritance of colour blindness.



Using letter **B** to represent the gene for normal colour vision and letter b to represent the gene for colour blindness. Work out the genotypes of:

i) Angela,

ii) Susan,

iii) George

iv) John. **(8 marks)**

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Biology II

012

22/07/2021 08.30 AM - 11.30 AM

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2020-2021

SUBJECT: BIOLOGY II

COMBINATIONS:

- BIOLOGY-CHEMISTRY-GEOGRAPHY **(BCG)**
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DURATION: 3 HOURS

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SECTION A: ATTEMPT ALL QUESTIONS (70 marks)

1) a) Define the following terms.

(i) Classification **(2 marks)**

(ii) Phylogeny **(2 marks)**

b) What is the relationship between natural classification and phylogeny? **(2 marks)**

2) Arrange the following cell organelles in their order of size starting with the largest:
Chloroplast, Endoplasmic reticulum, Centriole nucleus, Mitochondria, Lysosome, Ribosome. **(5 marks)**

3) Use Simpson's index to calculate the diversity of a habitat that contains the following Organisms:
20 woodlice, 5 Mice, 1 shrew, 32 Earthworms, 15 grasshoppers, 1 Owl. **(4 marks)**

4) The table below contains statements about four molecules. Complete the table by indicating with a tick (✓) or a cross (x) whether the statements apply to Haemoglobin , DNA, phospholipid or antibodies.

Statement	Haemoglobin	DNA	Phospholipids	Antibodies
Contain Iron				
Contains phosphate				
Able to replicate				
Hydrogen bonds stabilize the molecule				
Contain Nitrogen				

(5 marks)

5) Although Prokaryotes are more numerous and widespread than Eukaryotes, their level of complexity and efficiency is restricted. What has enabled Eukaryotes to become more complex. **(2 marks)**

6) Suggest reasons why Microvilli are only possible in animal cells but not in plant cells. **(2 marks)**

7) Assuming all other factors are kept constant, explain why increasing the concentration of substrate does not always increase the rate of reaction. **(2 marks)**

8) Fill in the missing appropriate terms in the following passage.
The primary structure of Protein is determined by sequence of .....which make up the .....chain.
The secondary structure results from coiling of folding of the chain due to.....formed between –NH and the.....group of the .....bond. **(5 marks)**

9) Compare and contrast active transport and facilitated diffusion. **(4 marks)**

10) a) Why do plants need to move water to their leaves? **(2 marks)**

b) Suggest why it is important that the products of Photosynthesis can be moved in both directions through the sieve tubes. **(3 marks)**

11) Suggest the advantages and disadvantages to farmers of crops that are genetically identical. **(4 marks)**

12) Explain how the environment can cause variation. **(3 marks)**

13) a) Explain how enzymes reduce the activation energy of a reaction. **(2 marks)**

b) Why do enzymes usually work only within very narrow PH range? **(2 marks)**

c) Suggest why enzymes are usually maintained at low concentrations in cells. **(2 marks)**

14) a) Describe the differences between a parasite and a pathogen. **(2 marks)**

b) Explain why people in the less economically developed countries are more likely to suffer from infectious diseases. **(5 marks)**

15) Explain why loss of genetic diversity means the species can no longer evolve. **(3 marks)**

16) a) What is the difference between T helper and T killer cells. **(2 marks)**

b) People who receive drug treatment for HIV/AIDS take a mixture of drugs that act in different ways. Suggest the advantages of taking a mix of drugs. **(3 marks)**

c) Antibiotics are prescribed to people who have HIV/AIDS for treatment of secondary infections, but not for treatment of HIV infection. Explain why this is so. **(2 marks)**

SECTION B: ATTEMPT ANY THREE QUESTIONS (30 marks)

17) a) What it the role of Mitosis? **(2 marks)**

b) Give the differences between Mitosis and Meiosis. **(8 marks)**

18) Comment on the flow of energy through ecosystems and discuss the various ways in which human activity can influence its flow at all levels in terrestrial ecosystem. **(10 marks)**

19) A number of current agricultural practices are of immediate benefit to farmers but may have long term adverse effects on humans and the environment. For each of the following agricultural practices, state the benefits and adverse environmental or human consequences.

a) Deforestation **(5 marks)**

b) Nitrogeneous Fertilisers **(5 marks)**

20) a) What is Natural selection? **(4 marks)**

b) What is the role of Mutation in Natural selection? **(6 marks)**

21) Explain how organisms have overcome the challenges of being Multicelllular. **(10 marks)**

BIOLOGY II

012

14/11/2019 **8:30 AM – 11:30 AM**

REB
Rwanda Education Board

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2019

SUBJECT: BIOLOGY

PAPER II: THEORY

COMBINATIONS:

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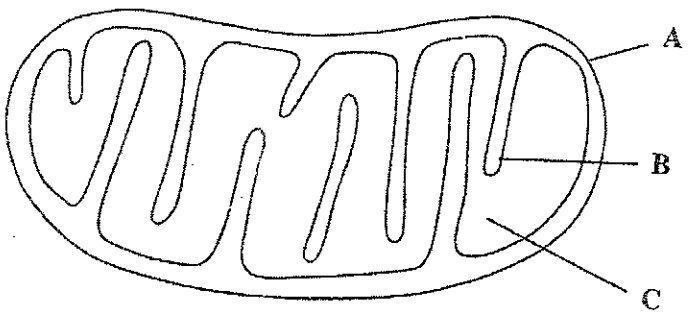
SECTION A: ATTEMPT ALL QUESTIONS. (70 marks)

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 β-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^{0}C. The starch was broken down by hydrolysis.
Explain how you would determine the rate of hydrolysis. **(4 marks)**

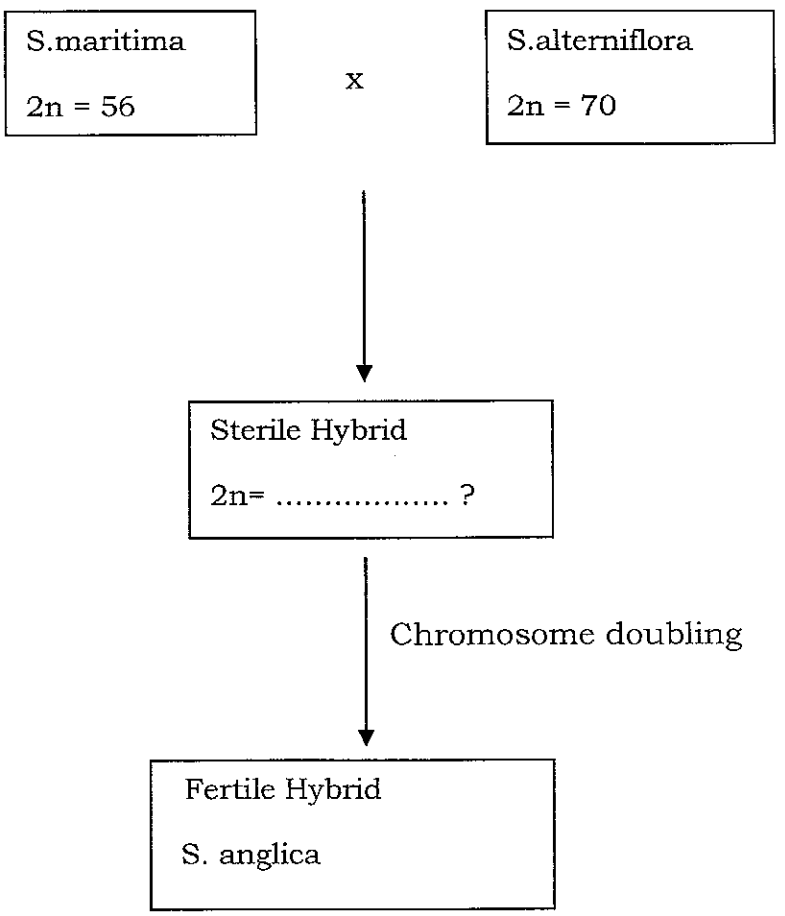
6) Water is sometimes described as a substance that provides an ideal environment for many organisms.
Explain how the Hydrogen bonds between water molecules affect the properties of water and help to make water an ideal environment for many organisms. **(5 marks)**

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)**

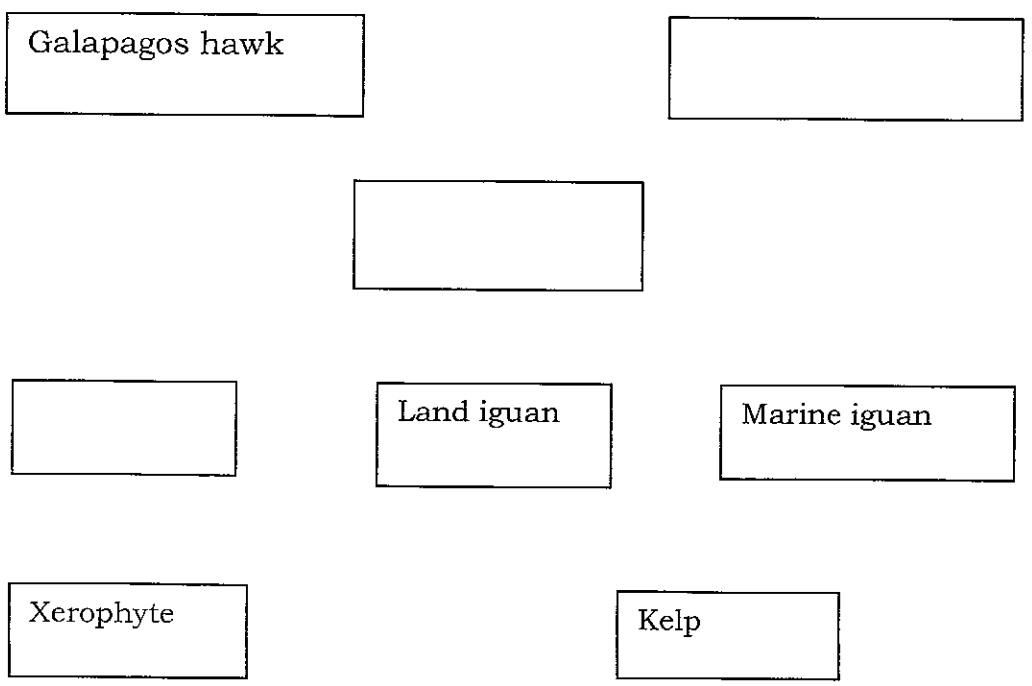
9) When investigating ecosystems, food chains and food webs are constructed. Read the passage below about trophic relationships on one of the Galapagos Islands.

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:

i) Filling in the blank boxes with names of the organisms.

ii) 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.

$(NH_2)_2\ CO + H_2O \xrightarrow{\text{Urease}} 2\ NH_3 + CO_2$

i) State the name of the process in the nitrogen cycle. **(1 mark)**

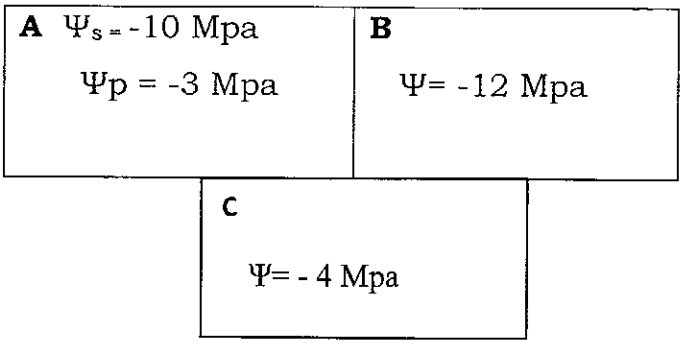
ii) Explain the importance of this process in making nitrogen from animals to be available for uptake by plants. **(2 marks)**

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 Progestrone. **(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)**

BIOLOGY II

012

10/11/2016 08.30am - 11.30am

REB
Rwanda Education Board

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2016

SUBJECT: BIOLOGY

PAPER II: THEORY

COMBINATIONS: - BIOLOGY-CHEMISTRY-GEOGRAPHY (BCG)
- MATHEMATICS-CHEMISTRY-BIOLOGY (MCB)
- PHYSICS-CHEMISTRY-BIOLOGY (PCB)

DURATION: 3 HOURS

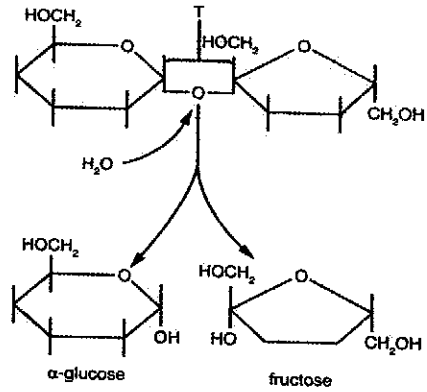
INSTRUCTIONS:

1) Do not open this question paper until you are told to do so.
2) 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.
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 **blue** or **black** pen.

SECTION A: ATTEMPT ALL QUESTIONS. (70 MARKS)

1) What are the four characteristics that all members of a species share? **(4marks)**

2) The figure below shows the break down of a sucrose molecule.

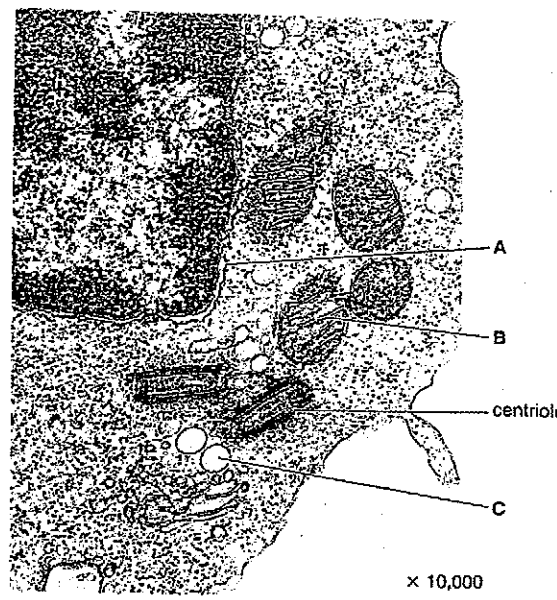


(a) Name the bond indicated by letter T. **(1mark)**

(b) State the name of this type of reaction in which water is involved. **(1mark)**

(c) State any two roles of water within plant cells other than taking part in breakdown reactions. **(2marks)**

3) The figure below is an electron micrograph of a part of an animal cell. A centriole is labeled.



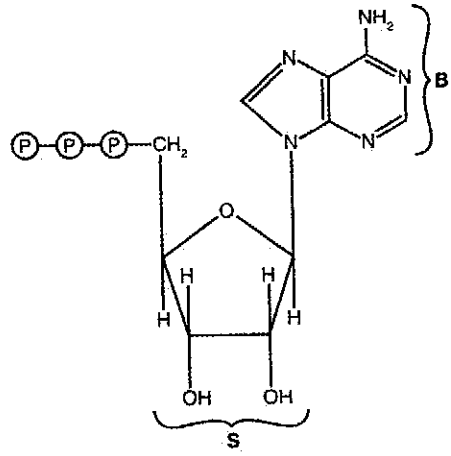
(a) Name the structures A, B and C. **(3marks)**

(b) Describe the roles of centrioles in animal cells. **(3marks)**

4) (a) Explain why DNA replication is described as semi-conservative. **(2marks)**

(b) The enzyme that catalyses the replication of DNA checks for errors in the process and corrects them. This makes sure that the cells produced in mitosis are genetically identical. Explain why checking for errors and correcting them is necessary. **(3marks)**

5) The figure below shows the structure of ATP.



(a) (i) Name the nitrogenous base labelled B. **(1mark)**

(ii) Name the sugar labelled S. **(1mark)**

(b) ATP is described as having a universal role as the energy currency in all living organisms. Explain why it is described in this way. **(4marks)**

6) (a) Cholera is transmitted by food and water that is contaminated by faecal matter. Suggest a reason why, in countries where cholera is common, babies who are breast fed are affected by cholera far less often than babies who are bottle fed. **(3marks)**

(b) Suggest reasons why injecting antibiotics into the blood can be effective in killing the cholera bacterium while the same antibiotic taken orally (by mouth) is not. **(4marks)**

7) Homozygous purple stemmed tomatoes were crossed with green stemmed plants. When the F1 were all purple stemmed. When the F1 plants were allowed to self pollinate, the resulting F2 produced 310 purple stemmed plants and 120 green stemmed plants.

(a) Which is the dominant allele? **(1mark)**

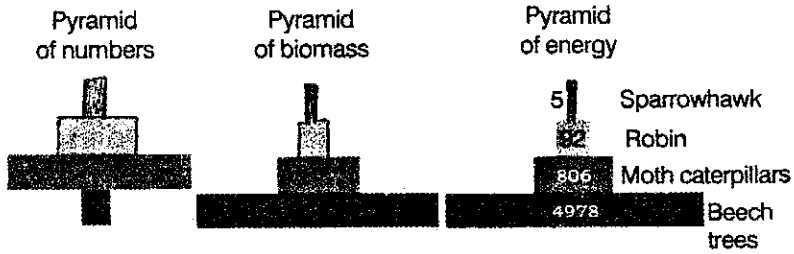
(b) Draw a genetic diagram to show the F1 and F2 crosses. **(5marks)**

8) (a) State one similarity and one difference between active transport and facilitated diffusion. **(2marks)**

(b) The presence of many mitochondria is typical of cells that carry out active transport. Explain why this is so. **(2marks)**

9) In the making of urine, glucose is initially lost from the blood but is then reabsorbed back into blood by kidney cells. Explain why it is important that this reabsorption occurs by active transport rather than diffusion. **(4marks)**

10) A study of a woodland food chain produced the following ecological pyramids:



(a) Which organisms are the primary consumers? **(1mark)**

(b) Calulate the percentage efficiency with which energy is transferred from moth carterpillars to robins. Show your working. **(2marks)**

(c) Suggest suitable units for the figures shown in the pyramids of energy. **(1mark)**

(d) In the pyramids of numbers, the block representing beech trees is smaller than that of moth carterpillars. In other pyramids it is larger. Explain this difference. **(3marks)**

11) Explain why animals are dependent on light energy. **(4marks)**

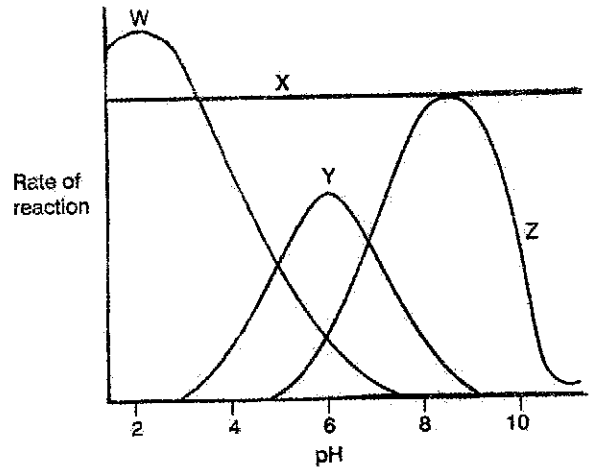
12) (a) Plant cells that have a water potential of – 600kPa are placed in solutions of different water potentials. State in each of the following cases whether, after 10 minutes the cells would be:

- Turgid
- Plasmolysis
- Incipient plasmolysis

Solution A = - 400 kPa
Solution B = - 600 kPa
Solution C = - 900 kPa
Solution D = pure water. **(4marks)**

(b) If an animal cell with a potential of – 700 kPa was placed in each of the solutions above; in which solutions is it likely to burst? **(1mark)**

13) The graphs below show the rate of reaction of four different protein-digesting enzymes over a range of pH.



(a) Suggest which enzyme would be most suitable to use to tenderise meat (break up meat fibres to make it easier to chew). **(4marks)**

(b) Why are proteins so important to living organisms? **(4marks)**

SECTION B: ATTEMPT ANY THREE QUESTIONS ONLY. (30 MARKS)

14) The mammalian oestrous cycle is controlled by hormones secreted by the pituitary gland and the ovaries. Describe the roles of the following hormones in the control of this cycle:

(a) The pituitary hormones FSH and LH. **(5marks)**

(b) The ovarium hormones, oestrogen and progesterone. **(5marks)**

15) Copy and complete the table below. **(10marks)**

Plant growth substance	Site of synthesis	Effect in plant
Auxin		
Gibberellin		
Cytokinin		
Abscisic acid		
Ethene		

16) (a) Define the term chromosomal aberration. **(2marks)**

(b) Describe different forms of chromosomal aberration. **(8marks)**

17) (a) Describe characteristics of enzymes. **(5marks)**

(b) Explain how a non-competitive inhibitor affects the rate of an enzyme-catalysed reaction. **(5marks)**

18) Describe the processes that are involved in protein synthesis. **(10marks)**

Biology II

012

12 /11/ 2015 08.30AM - 11.30AM

REB
Rwanda Education Board

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2015

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)**

SECTION A: ATTEMPT ALL QUESTIONS. (70MARKS)

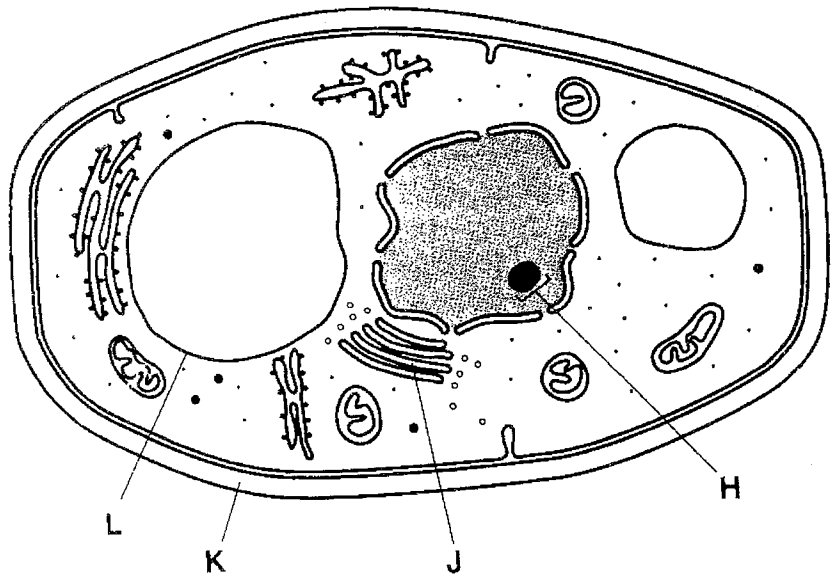
1) (a) The scientific name for human beings is Homo sapiens. Using this information and your knowledge of classification, fill the missing parts in gaps in the table below.

(4marks)

Kingdom:	.....
Phylum:	.....
Class:	mammalia
Order:	primates
Family:	Hominadae
.....:	Homo
.....:	Homo sapiens

(b) The system of classification shown above is described as hierarchical. What does this mean? **(2marks)**

2) The diagram below shows the structure of yeast- like fungus that lives in human lungs. It is eukaryotic.



(a) Name structures H, J, K, and L. **(4marks)**

(b) State two ways in which the structure of a prokaryotic cell differs from the one shown above. **(2marks)**

3) (a) What is the function of ribosomes? **(1mark)**

(b) In each of the following, name the organelle being referred to:
(i) Possesses structures called cristae
(ii) Contains chromatins
(iii) Synthesises glycoproteins
(iv) Digests worm out organelles **(4marks)**

4) Polysaccharides, such as glycogen, amylopectin and amylose, are formed by polymerization of glucose.
(a) Describe how the structure of glycogen differs from the structure of amylose. **(2marks)**

(b) Describe the advantages of organisms in storing glycogen rather than storing glucose. **(3marks)**

5) (a) The protein, haemoglobin has a globular structure. What does this mean? **(2marks)**

(b) How is the structure of globular protein linked to its function? **(4marks)**

6) (a) What are the basic components of a nucleotide? **(3marks)**

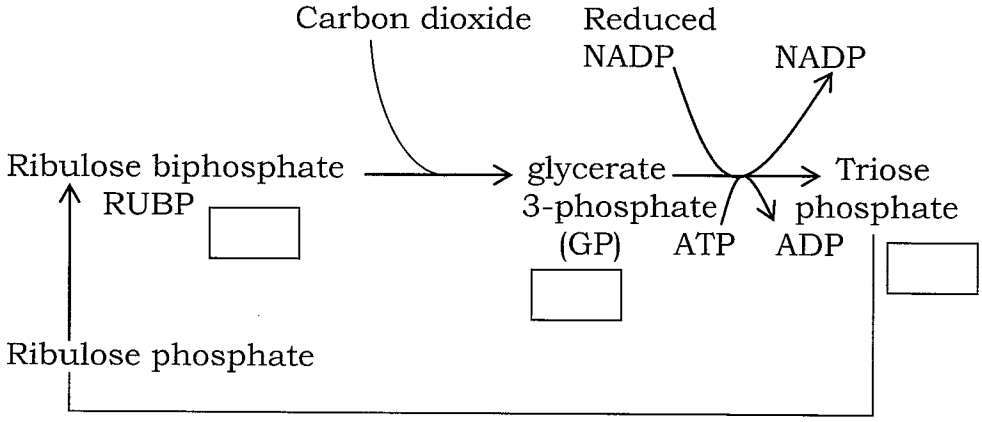
(b) In terms of structure of DNA molecule, explain why the base pairing are not adenine with guanine and thymine with cytosine. **(3marks)**

(c) The bases on one strand of DNA are TGGAGACT. What is the base sequence on the other strand? **(1mark)**

7) (a) Plasmodium falciparum is the causative agent of most severe forms of malaria. It is distributed throughout the tropics.
Explain why malaria is restricted to the tropics. **(3marks)**

(b) Cholera is transmitted by food and water that is contaminated with faecal matter. Suggest three measures that might be used to limit the spread of this disease. **(3marks)**

8) The diagram below shows the main stages in the light-independent reaction in photosynthesis.



(a) Write in the boxes in the diagram the number of carbon atoms in each of the relevant substances. **(1mark)**

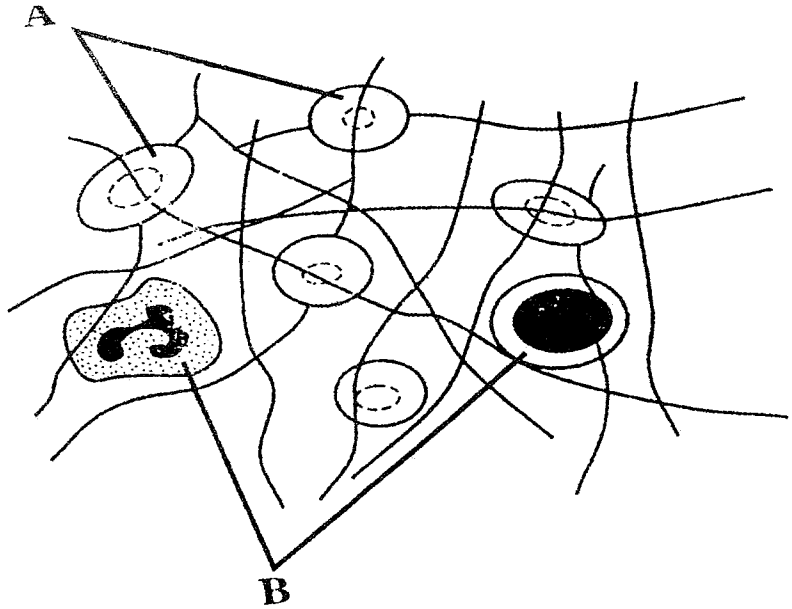
(b) What is the role of ATP in the conversion of:

(i) Glycerate -3-phosphate to triose phosphate. **(1mark)**

(ii) Ribulose phosphate to Ribulose biphosphate. **(1mark)**

(c) A plant was allowed to photosynthesise normally. The light was then switched off. Explain why there was a rise in the amount of glycerate-3-phosphate in the chloroplast of this plant. **(2marks)**

9) The diagram below shows a blood clot.



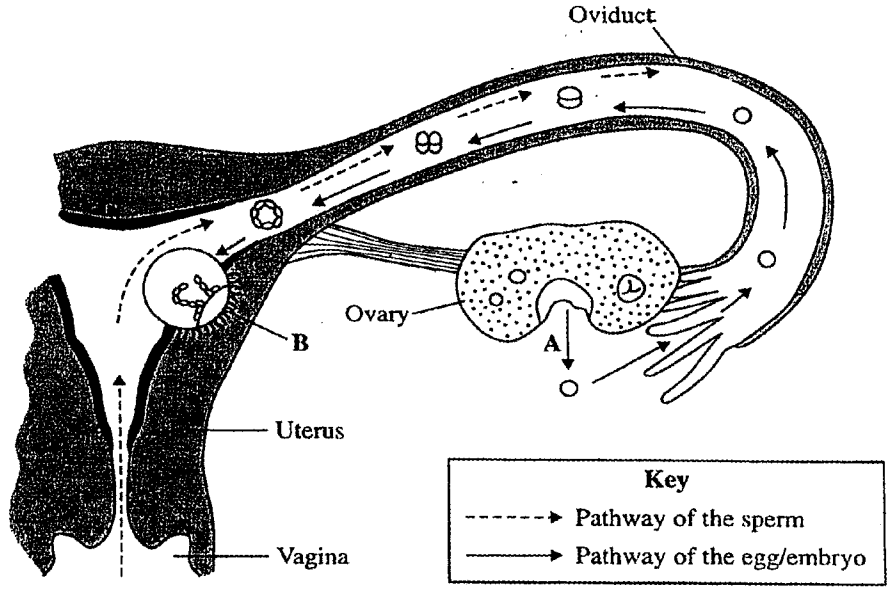
(a) (i) Name the type of blood cells labelled A. **(1mark)**

(ii) What is the function of blood cells labelled A? **(1mark)**

(iii) How does blood cell labelled B defend the body? **(2marks)**

(b) When you cut yourself, you bleed and quickly a blood clot form to prevent further bleeding. Explain how this helps a person to stay healthy. **(3marks)**

10) The diagram shows part of the female reproductive organs.



(a) Name the process shown at A. **(1mark)**

(b) (i) Write the letter X on the diagram to show where exactly fertilisation occurs. **(1mark)**

(ii) After fertilisation, implantation occurs. What will then form in the position marked B on the diagram? **(1mark)**

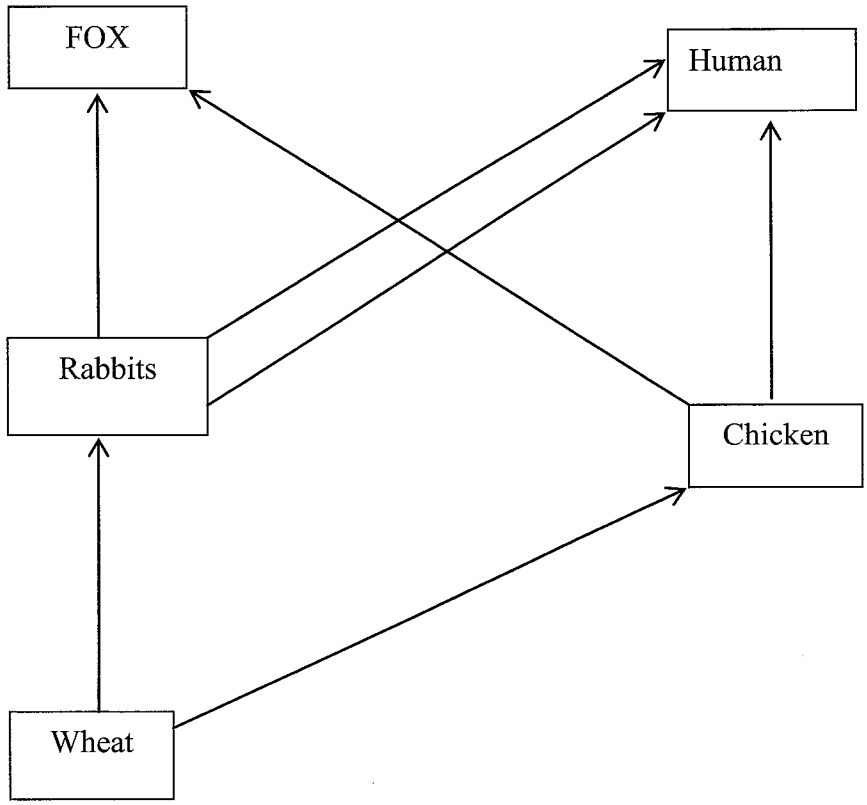
(iii) If fertilisation did not occur, what would happen? **(2marks)**

11) A man claims to be the father of a child who is blood group AB. The man is blood group O and the mother of the child is blood group A.
State with reasons whether the man could be the father of the child. **(3marks)**

12) (a) Define selection as used in evolution. **(1mark)**

(b) Distinguish between directional and stabilising selection. **(2marks)**

13) The diagram below shows a simple food web.



(a) Use the diagram to name: **(3marks)**

(i) A herbivore

(ii) An omnivore

(iii) A producer.

(b) The animals in food web get their energy from the food they eat.
From where do the wheat plants get their energy? **(1mark)**

(c) Draw a pyramid of energy for the following food chain.

Wheat ⟶ Rabbits ⟶ Fox **(2marks)**

SECTION B: ATTEMPT ANY THREE QUESTIONS. (30MARKS)

14) (a) Compare the roles of the endocrine and nervous system in control and coordination in animals. **(6marks)**

(b) Explain the roles of synapses in the nervous system. **(4marks)**

15) (a) Explain how meiosis and fertilisation can result in genetic variation amongst offsprings. **(5marks)**

(b) Explain how the environment may affect the phenotype of an organism. **(5marks)**

16) Mass flow hypothesis describes the movement of sucrose solution from high to low pressure.
What evidence is there for and against mass flow hypothesis? **(10marks)**

17) (a) Explain the importance of a human being maintaining a constant internal temperature. **(4marks)**

(b) Describe the role of the hypothalamus in the regulation of body temperature. **(3marks)**

(c) Explain why in a normal healthy individual, the blood glucose level fluctuates very little. **(3marks)**

18) What are the main functions of water to :
(a) Plants? **(4marks)**
(b) Animals? **(3marks)**
(c) All organisms? **(3marks)**

BIOLOGY II

012

31 Oct. 2014 08.30AM - 11.30AM

REB
Rwanda Education Board

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2014

SUBJECT: BIOLOGY

PAPER II: THEORY

COMBINATIONS: - BIOLOGY-CHEMISTRY-GEOGRAPHY (BCG)

- MATHEMATICS-CHEMISTRY-BIOLOGY (MCB)

- PHYSICS-CHEMISTRY-BIOLOGY (PCB)

DURATION: 3 HOURS

INSTRUCTIONS :

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   - **Section B**: Attempt any **three** questions. **(30 marks)**

SECTION A: ATTEMPT ALL QUESTIONS. (70 marks)

1. (a) Give two advantages of the electron microscope over a light microscope. **(2marks)**

   (b) What is the difference between magnification and resolution? **(3marks)**

2. Give at least four differences between Eukaryotic and Prokaryotic cells. **(4marks)**

3. The table below refers to features of animal, plant and Prokaryotic cells.

   Copy the table and place (√) in the appropriate box if the feature is present and (X) if the feature is absent. **(5marks)**

Feature	Animal cell	Plant cell	Prokaryotic cell
Cell wall made of cellulose			
Endoplasmic reticulum			
Mesosome			
Ribosome			
Golgi apparatus			

4. Explain which way water will move by osmosis in each of the following sets of cells. **(6marks)**

N°1

Cell A	Cell B
Y= -50 kpa	Y= -250 kpa

N°2

Cell A	Cell B
Y= -500 kpa	Y=0 kpa

N°3

Cell A	Cell B
Y= -200 kpa	Y=-200 kpa

Psi = Y_w = water potential

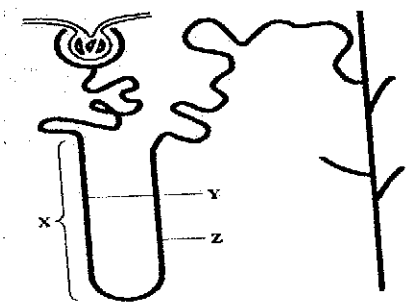
Kpa = kilopascals

5. (a) Give two similarities between DNA replication and transcription. **(2marks)**

   (b) Give two differences between DNA replication and translation. **(2marks)**

6. Vaccination, together with identification and isolation of infectious persons as helped to eradicate smallpox, but not measles, tuberculosis, malaria and cholera. Giving one reason for each of the four diseases, explain why each one is more difficult to eradicate than smallpox. **(4marks)**

7. The diagram below represents a Nephron from a human kidney.



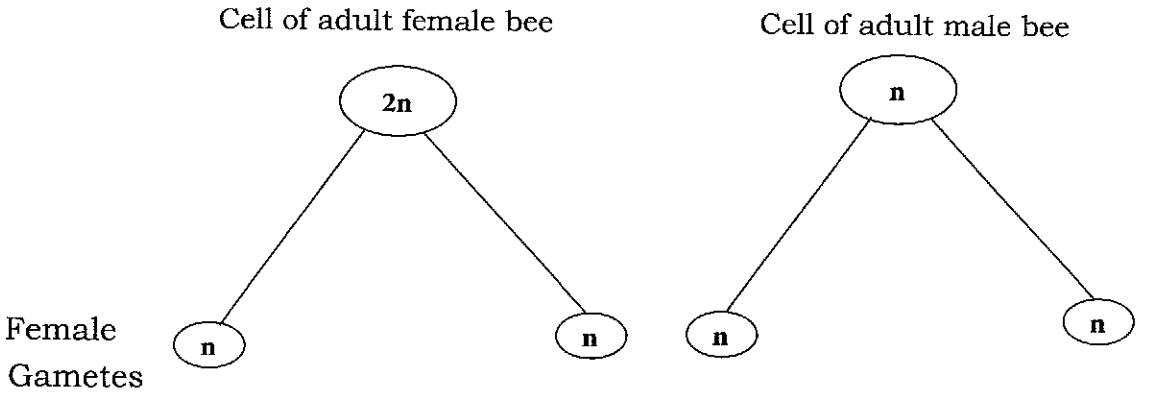
   (a) Name the part labeled X **(1mark)**

   (b) Sodium chloride is actively pumped out of Z into the medulla of the kidney.

This sodium chloride moves back into Y. Explain the effect of the sodium chloride concentration in the medulla of the kidney on the reabsorption of water from the collecting duct. **(2marks)**

(c) Most of the sodium chloride filtered into the glumerular filtrate is reabsorbed. From which part of the nephron does this reabsorption take place? **(2marks)**

8. The queen honey bee can lay both fertilised and unfertilized eggs. Fertilised eggs develop into diploid females and unfertilized eggs develop into haploid males. The diagram below shows the formation of gametes in female bees and male bees.



(a) Giving a reason for your answer in each case, name the type of cell division in the bee that produces :

i. Female gamete. **(2marks)**

ii. Male gamete. **(2marks)**

(b) The table below shows some features which contribute to variation in the offspring of bees. Copy and complete the table with a tick **(√)** if the feature may contribute or a cross **(X)** if it does not. **(3marks)**

Feature	**Female offspring**	**Male offspring**
Crossingover		
Independent segregation of chromosomes		
Random fusion of gametes		

9. (a) Explain the meaning of the term " gene frequency'. **(2marks)**

(b) List three factors which may alter the gene frequency in a small population. **(3marks)**

10. The temperature control centre coordinates the mechanism which regulate body temperature.

(a) Where is the temperature control centre in the brain? **(1mark)**

(b) Describe how the temperature control centre detects a rise in body temperature and produces an increase in the rate of sweating. **(2marks)**

11. In the world, forests are being burned and ploughed for agriculture.

How is this likely to affect the carbon content of:

(a) the air **(2marks)**

(b) The soil ? **(2marks)**

Explain your answer.

12. Explain the following ecological terms:
    (a) Pyramids of biomass. **(2marks)**
    (b)Net primary production. **(2marks)**
    (c) Community. **(2marks)**
13. With reference to flowering plants, distinguish between :
    (a) Pollination and fertilization. **(2marks)**
    (b) Pollen grain and male gamete. **(2marks)**
14. (a) There are two sounds during each heart beat. Explain the source of these sounds. **(2marks)**
    (b) What is the function of the smooth muscle in the walls of thearteries? **(2marks)**
15. Explain the following terms in relation to the nervous system.
    (a) Action potential. **(2marks)**
    (b) Refractory period. **(2marks)**

SECTION B: ATTEMPT ONLY THREE QUESTIONS. (30 marks)

16.(a) What is meant by the terms :
    i. "Continuous variation"? **(2marks)**
    ii. "Discontinuous variation"? **(2marks)**
    (b) How does each of the variations arise? **(6marks)**
17. Fats and glycogen are energy storage compounds in animals.
    (a) Compare the suitability of the two substances as storage compounds. **(4marks)**
    (b) State the advantage of storing fats over glycogen. **(3marks)**
    (c) Why is glycogen a more suitable energy compound in muscles than fat? **(3marks)**
18. In an oil seed plant species, the allele for tallness is dominant over that for dwarfness. Meanwhile the allele for chlorophyll production and non-chlorophyll production show incomplete dominance.
    The heterozygous plants are variegated.
    (a) Using suitable symbols, construct a diagram of a cross between a tall plant with green leaves and a dwarf plant with variegated leaves, to show the genotypes of the offsprings. **(8marks)**
    (b) Explain why 25% of the offsprings above would fail to survive. **(2marks)**
19.(a) Define the term "parasitism". **(2marks)**
    (b) Give all possible ways which enable a parasite to live with its host. **(8marks)**
20. Describe the sequence of events that occur when a nerve impulse arrives at a neuromuscular junction. **(10marks)**

Biology II

012

31 Oct. 2013 08.30am - 11.30am

REPUBLIC OF RWANDA

RWANDA EDUCATION BOARD

ADVANCED LEVEL NATIONAL EXAMINATIONS 2013

SUBJECT: BIOLOGY

PAPER II: THEORY

COMBINATIONS: - BIOLOGY-CHEMISTRY-GEOGRAPHY: BCG
- MATHEMATICS-CHEMISTRY-BIOLOGY: MCB
- PHYSICS-CHEMISTRY-BIOLOGY: PCB

DURATION: 3 HOURS

INSTRUCTIONS:

1. Don't open this question paper until you are told to do so.
2. This paper consists of **two** sections: **A** and **B**.
   - **Section A**: Attempt **all** questions. **(70 marks)**
   - **Section B**: Attempt any **three** questions. **(30 marks)**

SECTION A: Attempt all questions in this section. ***(70 marks)***

1. a) A cell is defined as the structural and functional unit of any living organism. Explain this. ***(2 marks)***

   b) Why are cells said to be units of life? ***(1 mark)***

2. a) Why would you expect to find abundant rough endoplasmic reticulum in the pancreas? ***(2 marks)***

   b) Why do we stain biological sections when observing under a microscope? ***(2 marks)***

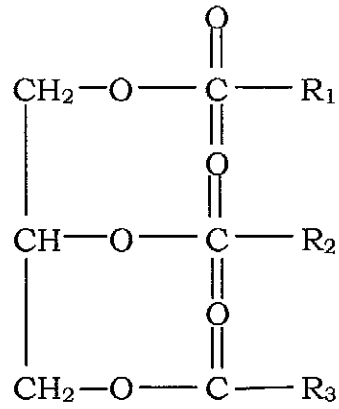
3. Below is a classification of an earthworm.
   Kingdom: Animal
   Phylum: Annelida
   Class: Oligochaeta
   Order: Terricolae
   Family: Lumbricidae
   Genus: Lumbricus
   Species: Terrestris.

   (2 marks)

   Give the scientific name of the earthworm.

4. Give two main differences between diffusion and active transport. ***(2 marks)***

5. Look at the diagram of the triglyceride.



   a) Name the two different types of molecules that make up this triglyceride. ***(2 marks)***

b) Name the bond between these molecules. ***(1 mark)***

6. a) Digestive glands secrete enzymes. What initiates these secretions? ***(3 marks)***

b) Digestion is either entirely extracellular or intracellular or both. Give examples of organisms which have:

i. Extracellular;
ii. Intracellular; ***(3 marks)***
iii. Both extracellular and intracellular.

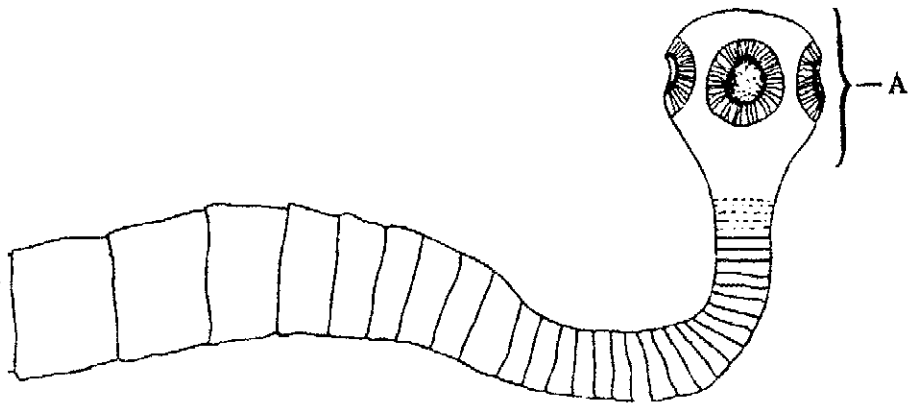
7. Explain each of the following statements.

a) If you stand on your head it is possible to swallow food. ***(2 marks)***

b) Secretion of gastric juice may start before the food reaches the stomach. ***(2 marks)***

c) If the bile duct is blocked, digestion of fats is stopped. ***(2 marks)***

8. The diagram below shows a part of the beef tapeworm taenia saginata.

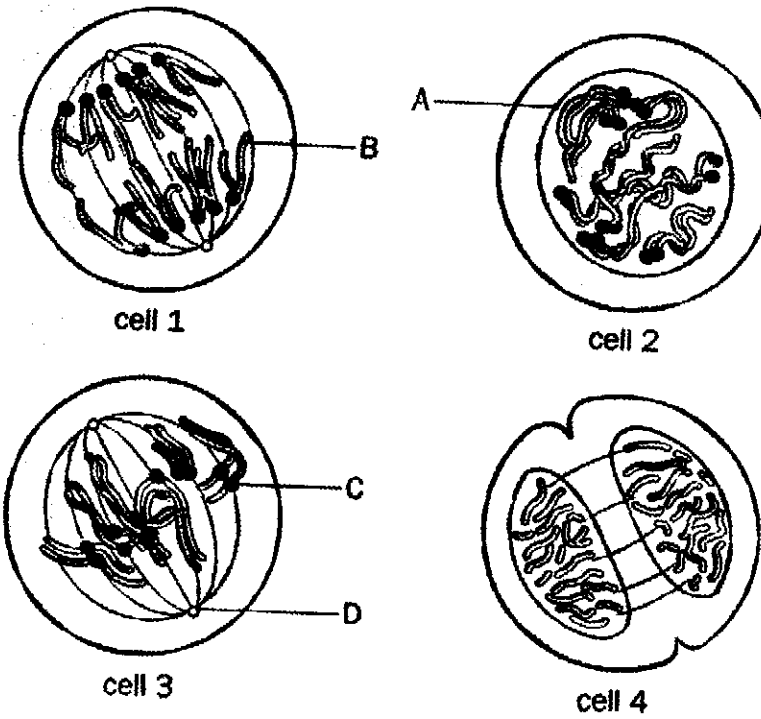


a) Explain the importance of the part labelled A in the life of the tapeworm. ***(2 marks)***

b) Describe how the tapeworm obtains its nutrients. ***(2 marks)***

c) How does the nutrition of rhizopus differ from that of the tapeworm? ***(2 marks)***

9. The diagrams below show four animal cells at different stages of mitosis.



a) Name the structures labelled A, B, C and D. ***(4 marks)***

b) i. Name the stages of division shown by cells 1 and 3. ***(2 marks)***
ii. Use the numbers of each cell to arrange the stages in the correct sequence of mitosis. ***(1 mark)***

d) How does mitosis maintain genetic stability in an organism? ***(1 mark)***

10. a) What physiological events would you expect to follow the injection of a small quantity of glucose into the blood stream of a healthy mammal? ***(2 marks)***

b) What would be the result of injecting glucose into the blood stream of a man whose pancreas has been removed? ***(2 marks)***

c) Algae are not associated with disease like many fungi and bacteria. Explain. ***(2 marks)***

11. Explain fully the following biological terms:
a) Double circulation; ***(4 marks)***

b) Double fertilization. ***(4 marks)***

12. Match each level of protein structure with the correct description. ***(4 marks)***

Protein structure	**Description**
A. Primary structure	**A**. The twisting of the amino acid chain into helix held together with hydrogen bonds
B. Secondary structure	**B**. The association of a number of polypeptide chain
C. Tertiary structure	**C**. The sequence of amino acids in polypeptide chain.
D. Quaternary structure	**D**. The folding of the polypeptide into a complex three-dimensional shape.

13. What are the advantages of supplying the pulmonary circulation with blood at a lower pressure than that of the systemic circulation? ***(5 marks)***

14. a) Define "Locomotion". ***(1 mark)***

    b) What is the basic reason for the fact that animals show locomotion whereas plants do not? ***(3 marks)***

15. a) What are mutations? ***(1 mark)***

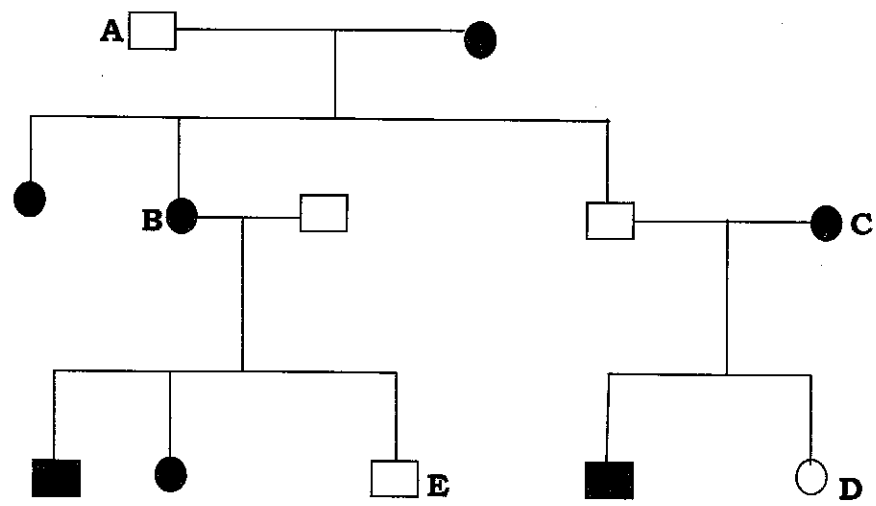
    b) What are causes of mutations? ***(2 marks)***

SECTION B: ATTEMPT ANY THREE QUESTIONS. (30 marks)

16. a) What is meant by the term homologous chromosomes? ***(2 marks)***

    b) State three ways by which meiosis creates genetic variation. ***(3 marks)***

    c) Red-green colour blindness is a sex-linked recessive condition. The gene of colour blindness is carried on the X-chromosome. The figure below shows a family tree. Workout the genotype of individuals labelled A —E. ***(5 marks)***



KEY

● Normal Female	○ Colour blind Female
■ Normal Male	□ Colour blind Male

17. a) Define the following biological terms.

    i. Photosynthesis. ***(2 marks)***
    ii. Tissue respiration. ***(2 marks)***

    b) State the differences and similarities between photosynhesis and tissue respiration. ***(6 marks)***

18. a) What is variation? Give an example. ***(2 marks)***

    b) Give the two types of variation. ***(2 marks)***

    c) There are many ways in which humans can vary from each other. For each of these ways indicate whether you think the variation you have mentioned is due to genes or environmental influence or both. ***(6 marks)***

19. Write short notes on the ecological aspects of the following: ***(10 marks)***
    a) Conservation.

    b) Deforestation.

20. a) Distinguish between Aerobic and Anaerobic respiration. ***(10 marks)***

b) Outline the process of glycolysis.

c) c) How is energy produced in glycolysis?

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Biology II	
012	
14 Nov. 2012	02.00pm - 05.00pm

REPUBLIC OF RWANDA

RWANDA EDUCATION BOARD (REB)

ADVANCED LEVEL NATIONAL EXAMINATIONS 2012

SUBJECT: BIOLOGY II

COMBINATIONS: - BIOLOGY-CHEMISTRY-GEOGRAPHY (BCG)
- MATHEMATICS-CHEMISTRY-BIOLOGY (MCB)
- PHYSICS-CHEMISTRY-BIOLOGY (PCB)

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **two** sections: **A** and **B**.

Section A: Attempt **all** questions. **(70 marks)**

Section B: Attempt any **three** questions. **(30 marks)**

SECTION A : Attempt all questions. ***(70 marks)***

01. (a) What is cell's protoplast? ***(1 mark)***

(b) List two processes carried out by the cell's protoplast? ***(3 marks)***

02. (a) Give three properties of cell membrane? ***(3 marks)***

(b) Name two other membranes in the cell with similar properties as the cell membrane. ***(2 marks)***

03. (a) There are many types of proteins in a membrane. Describe the role of any two proteins. ***(2 marks)***

(b) State two roles of cholesterol in the membrane. ***(2 marks)***

04. (a) Name the solvent for all the materials that are transported around the plants. ***(1 mark)***

(b) Explain the processes that are involved in the transport of sap in the following tissues.

(i) The xylem. ***(2 marks)***

(ii) The phloem. ***(2 marks)***

05. Explain two differences between Xylem and Phloem. ***(2 marks)***

06. Plants constantly lose water by evaporation.

(a) Explain how plants compensate for this. ***(1 mark)***

(b) Describe one benefit of transpiration stream for a plant. ***(2 marks)***

07. Explain why the gut of a carnivore needs to be short with fewer infoldings than that of herbivores. ***(3 marks)***

08. (a) Explain the difference between closed and open systems of circulation. ***(2 marks)***

(b) When comparing the two types of closed circulatory systems, explain why a double circuit is more efficient than a single circuit. ***(3 marks)***

09. (a) The liver produces bile. Briefly state two main functions of bile in the digestion. ***(2 marks)***

(b) Describe how bile is considered an excretory product as well as a digestive secretion. ***(2 marks)***

(c) Name two principal hormones controlling the production and release of bile and state the effect of each. ***(4 marks)***

10. Briefly explain the role each of the following has in a mammalian locomotion.

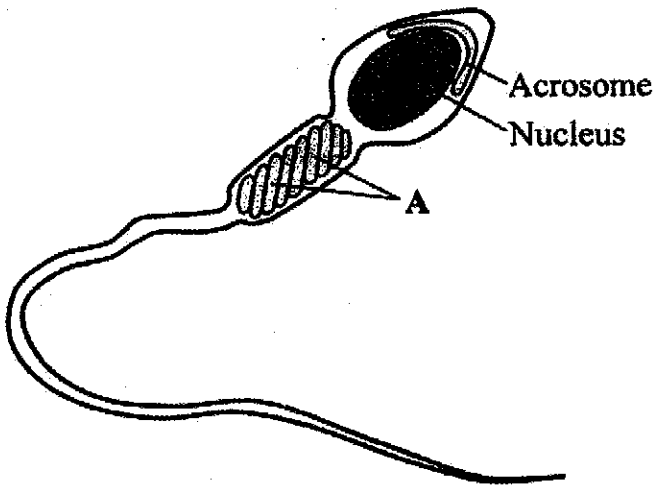
(a) Ligament. ***(1 mark)***

(b) Tendom. ***(1 mark)***

(c) Bones. ***(1 mark)***

(d) Joints. ***(1 mark)***

11. The diagram below shows the structure of a human sperm.



(a) Explain the part played by the organelle labelled A in the process leading to fertilization. ***(2 marks)***

(b) The acrosome contains an enzyme that breaks down proteins.
Describe the function of this enzyme in the process leading to fertilization. ***(2 marks)***

12. The turnover number of an enzyme is defined as the number of substrate molecules converted to product by one molecule of enzyme in one minute. In an experiment carried out at 20°C, the turnover number for an enzyme was found to be 2500 at the start of the experiment, but dropped to 1000 after 5 minutes.

(a) Suggest why the turnover number decreased after 5 minutes. ***(2 marks)***

(b) How do you expect the turnover number to differ from 2500 at the start of an identical experiment but carried out at 30°C? Explain your answer. ***(2 marks)***

(c) Explain why it would be important to have a control in this experiment at 20°C and at 30°C. ***(1 mark)***

13. The rate of diffusion of a molecule across a membrane depends on the relative concentration of the molecule on either side of the membrane, the membrane thickness and its surface area.

$$Rate\ of\ diffusion = \frac{surface\ area \times difference\ in\ concentration}{thickness\ of\ the\ membrane}$$

(a) For a maximum diffusion to take place, which factor should:

(i) Be as large as possible? ***(1 mark)***

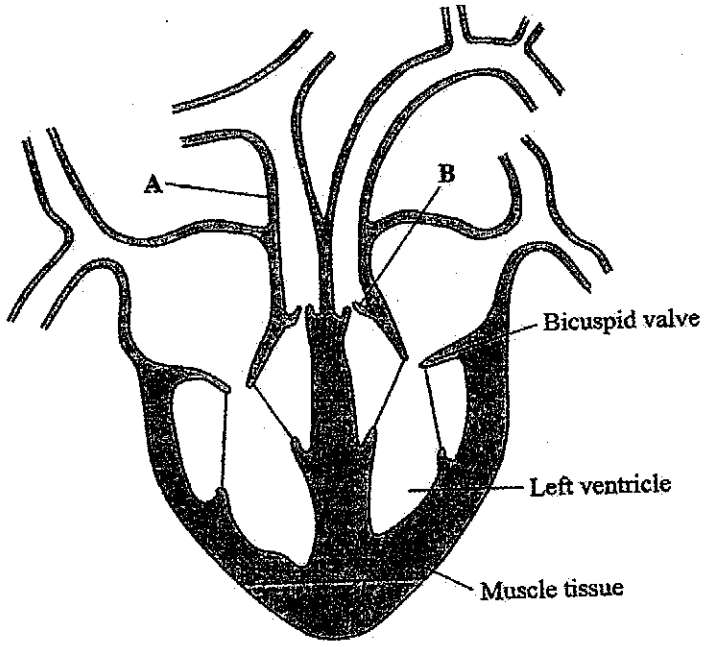
(ii) Be as small as possible? ***(1 mark)***

(b) Use the equation to explain how the following are adapted for efficient gas exchange.

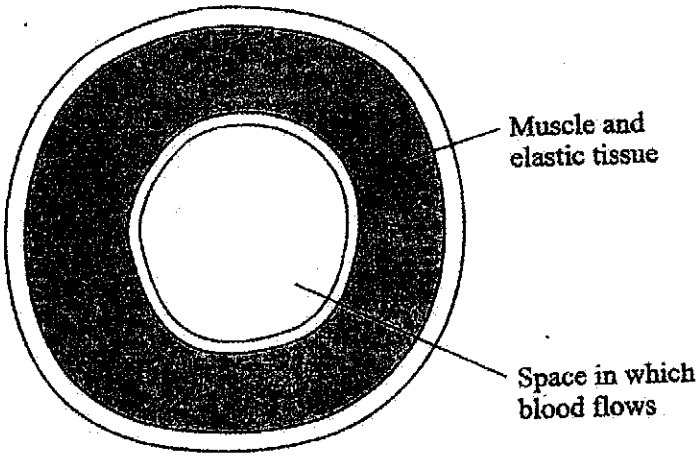
(i) A single-celled amoeba. ***(1 mark)***

(ii) The human lungs. ***(1 mark)***

14. The diagrams show a vertical section of the heart and a cross-section of an artery.



Heart



Artery

(a) Name the structures labelled A and B. ***(2 marks)***

(b) A pulse can be felt as blood flows through an artery. Explain how tissues labelled in both diagrams help to produce this pulse. ***(3 marks)***

(c) What is meant by the term pulse rate? ***(1 mark)***

15. Flower colour in pea plant is determined by two allelomorphic pairs of genes (R, r) and (S, s). If at least one pair is present the flowers are purple. All the other genotypes are white.

If two purple plants, each having the genotype RrSs are crossed, what will be the phenotypic ratio of the offsprings? Show your working. ***(6 marks)***

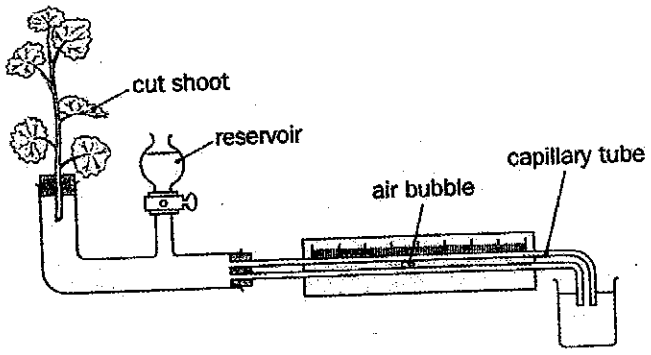
16. Explain the role of Natural Selection in the evolution of new species. ***(3 marks)***

SECTION B: Attempt ONLY any THREE questions. ***(30 marks)***

17. (a) Describe any THREE xeromorphic adaptations of plants. ***(3 marks)***

(b) How are animals adapted to survive in desert areas? ***(7 marks)***

18. The figure below is a simple potometer used to investigate the rate of transpiration under different conditions.



What do you think would happen to the rate of transpiration under:

(a) High humidity?

(b) High wind speed?

(c) High temperatures?

(d) High light intensity? ***(10 marks)***

19. (a) Define the following ecological terms.

(i) Population. ***(1 mark)***

(ii) Ecosystem. ***(1 mark)***

(b) Discuss the various factors that influence the population growth of organisms in a closed ecosystem. ***(8 marks)***

20. (a) Explain the importance of mitosis. ***(4 marks)***

(b) State at least six differences between mitosis and meiosis. ***(6 marks)***

21. (a) Giving examples in man, explain the following genetic characters. ***(6 marks)***

(i) Sex linked characters.

(ii) Sex limited characters.

(b) How is sex determined in human beings? ***(4 marks)***

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BIOLOGY II

011

7 Nov. 2011 8.30 am – 11.30 am

REPUBLIC OF RWANDA

RWANDA EDUCATION BOARD (REB)
P.O BOX 3817 KIGALI TEL/ FAX: 586871

ADVANCED LEVEL NATIONAL EXAMINATIONS 2011

SUBJECT : BIOLOGY II

COMBINATIONS : Physics –Chemistry- Biology (PCB)
Maths- Chemistry- Biology (MCB)
Biology- Chemistry- Geography (BCG)

DURATION : 3 HOURS

INSTRUCTIONS:

This paper consists of two sections **A** and **B**
Attempt all questions in section **A**. **(70 marks)**
Answer **any Three** questions in section **B**. **(30 marks)**

SECTION A: Answer all questions (70 marks)

1.a) Water enters plant cells by the process of osmosis. Explain why the cells don't burst during this process. **(2 marks)**

b) Why is cell membrane described as a bilayer? **(1 mark)**

c) How does the membrane structure help to keep solutions apart? **(2 marks)**

2.a) What is the function of mitochondrion? **(1 mark)**

b) Explain why muscles have a high number of cristae per mitochondrion **(2 marks)**

3. Suggest the cellular processes that would be taking place in the following Cells.

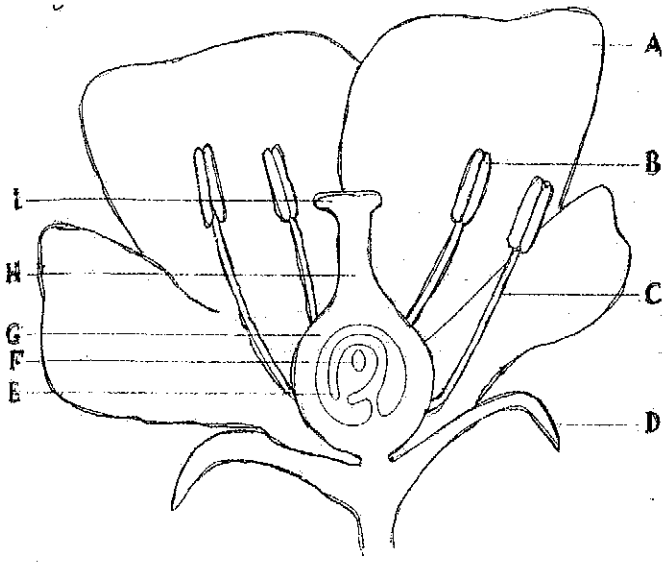
a) A cell in which the membrane contained many microvilli. **(1 mark)**

b) A cell with many rough endoplasmic reticulum. **(1 mark)**

c) A cell with a large number of golgi bodies. **(1 mark)**

d) A cell with much smooth endoplasmic reticulum. **(1 mark)**

4. The diagram below represents a flower



a) Give the letter of the structure which :

i) becomes the fruit wall. **(1 mark)**

ii)becomes the testa. **(1 mark)**

iii)produces pollen grains. **(1 mark)**

b) Explain two ways shown in the diagram in which this flower is adapted for insect pollination. **(2 marks)**

5. Draw a well labelled diagram to show that there is an equal chance of parents producing a baby boy or girl. Use the symbols X and Y for the chromosomes. **(4 marks)**

6.a) Describe the functions of centromere during mitosis. **(2 marks)**

b) List three similarities between mitosis and meiosis. **(3 marks)**

7.a) Give two similarities between transcription and DNA replication. **(3 marks)**

b) If the diploid number of chromosomes for a specie is 46, how many chromosomes are present in:

i) spermatogonium **(1 mark)**

ii) a primary Oocyte **(1 mark)**

iii) a secondary Oocyte **(1 mark)**

8. Explain the main difference between the lock and key and the induced fit models of enzyme action. **(3 marks)**

9. a) Name the gaseous exchange surface in:

i) Humans **(1 mark)**

ii) Plants **(1 mark)**

iii) Fish **(1 mark)**

b) Explain how efficient gas exchange is achieved in plants. **(3 marks)**

10. The following equations summarise three reversible reactions that occur in mammalian blood:

Equation 1

$$H_2O + CO_2 \rightleftharpoons H_2CO_3$$

Equation 2

$$H_2CO_3 \rightleftharpoons HCO^-_3 + H^+$$

Equation3

$$H^+ + HbO_2 \rightleftharpoons HHb + O_2$$

a) Which of these reactions involves the enzyme carbonic anhydrase ? **(1 mark)**

b) What is the function of hydrogen carbonate ions produced in equation 2?

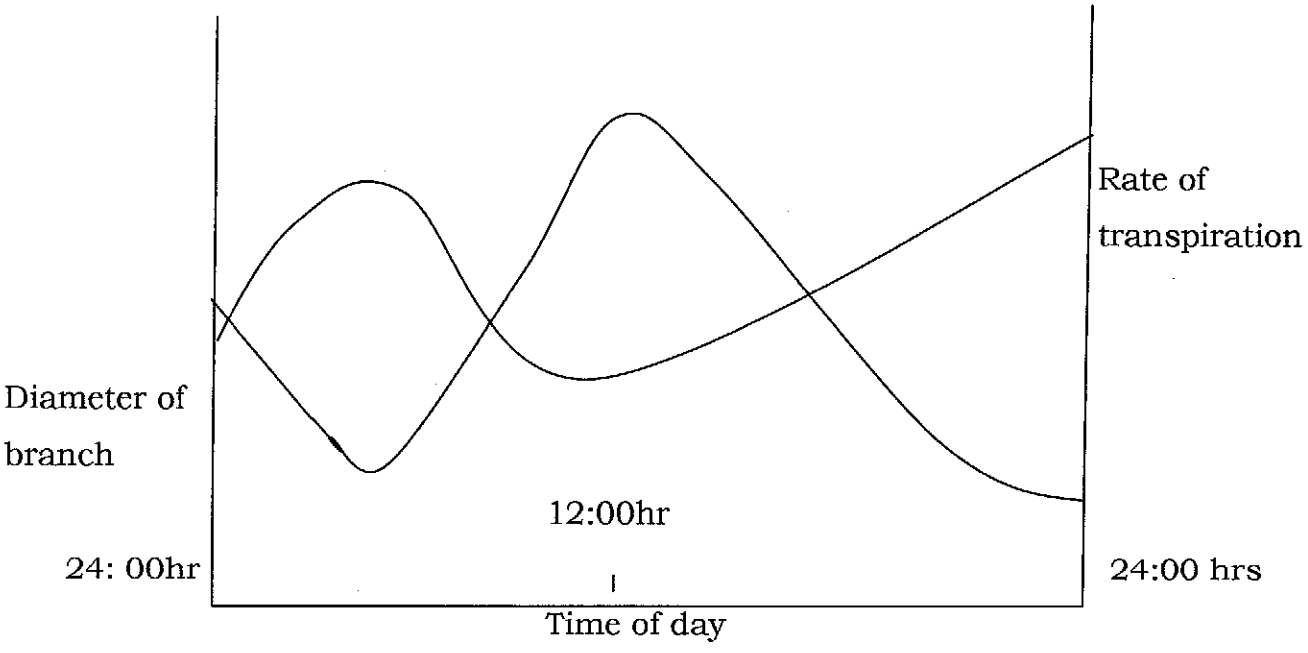
(2 marks)

c) What effect do the reactions left to right in equation 1 and 2 have on the oxygen dissociation curve of haemoglobin? **(1 mark)**

d) In which component of the blood do ll the above reactions occur? **(1 mark)**

11. Land plants have most stomata on the lower leaf surface. Floating aquatic plants have many stomata on the upper surface of their leaves. Suggest some advantages of this arrangement. **(4 marks)**

12. The graph below shows the relationship between the rate of transpiration and the diameter of a branch.



a)Explain the graph. **(2 marks)**

b)Explain why Carbohydrates are transported as sugars and not starch.

(2 marks)

13. State one function of each of the following compounds in an organism.

a) Phospholipid

b) Collagen

c) Cellulose

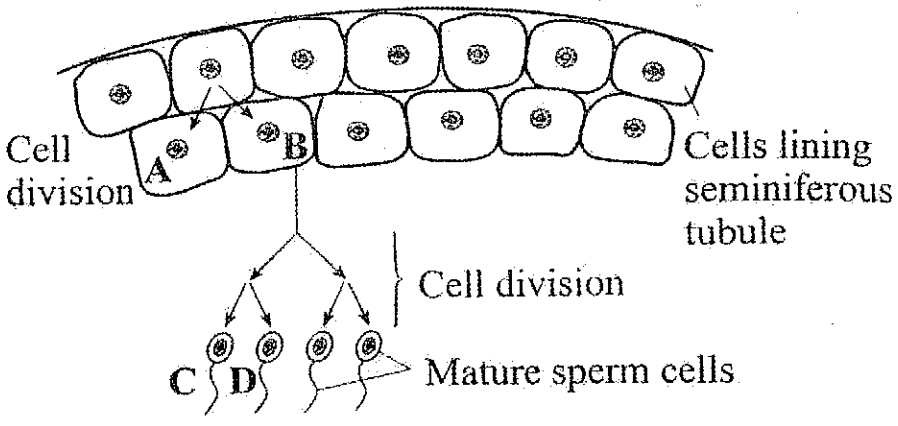
d) Globular protein

(4 marks)

14. a) What does the term oxidative phosphorylation mean? **(2 marks)**

b) Describe the function of the electron transport chain. Where is it located in the mitochondrion? **(3 marks)**

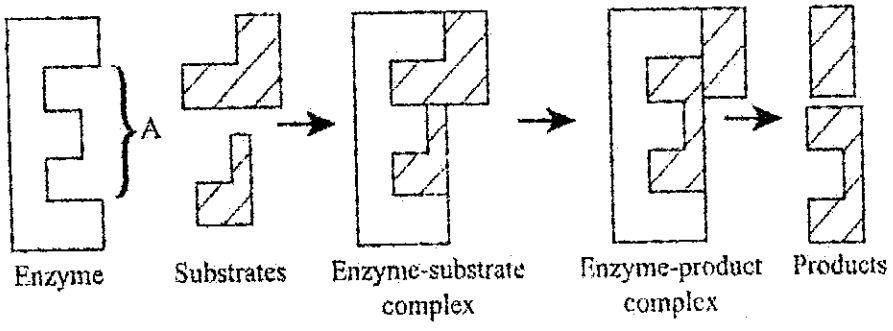
15. The diagram below shows the process of sperm formation in a mammalian Testis.



a) Explain why cells A and B are genetically identical. **(1 mark)**

b) Describe two ways in which cell division leads to cells C and D being genetically different.

16. The diagram below illustrates one model of enzyme action



a) Name the part of the enzyme labelled A. **(1 mark)**

b) Explain how this model can account for enzyme specificity **(2 marks)**

c) With reference to the model, explain the effect of a competitive Inhibitor on an enzyme-catalysed reaction. **(2 marks)**

SECTION B: Answer any three questions (30 marks)

17. a) List Four similarities between DNA and RNA **(4 marks)**

b) Explain why the genetic code of must be triplet and not doublet. **(2 marks)**

c) What is the significance of protein synthesis? **(4 marks)**

18. a) State two functions of mitosis. **(2 marks)**

b) Write a brief account of the process of mitosis in an animal cell **(8 marks)**

19. a) (i) What does 'asexual reproduction' mean? **(1 mark)**

(ii) Give two examples off asexual reproduction in animals **(2 marks)**

b) Why do animals generally produce more spermatozoa than eggs? **(1 mark)**

c) Describe (i) three differences and

(ii) three similarities between the formation of male and female gametes in humans. **(6 marks)**

20. a) Explain the following ecological terms:

(i) Ecological succession, **(2 marks)**

(ii) Climax vegetation, **(2 marks)**

(iii) Biodiversity. **(2 marks)**

b) Distinguish between the following pairs of terms as used in ecology

(i)Density dependent factors and **(2 marks)**

(ii)Density independent factor

Give an example of each. **(2 marks)**

21. a) Why do different enzymes have different optimum PH? **(2 marks)**

b) What is the difference between a reversible and an irreversible enzyme inhibitor? **(4 marks)**

c) Explain the term cofactor and give two examples of cofactors. **(4 marks)**

Biology I

013

09th Nov.2006 8.30 - 11.30a.m

RWANDA NATIONAL EXAMINATIONS COUNCIL

P.O BOX 3817 KIGALI-TEL/FAX : 586871

ADVANCED LEVEL NATIONAL EXAMINATIONS 2006

SUBJECT : BIOLOGY I

OPTION : BIOLOGY-CHEMISTRY

DURATION : 3 HOURS

INSTRUCTIONS :

Answer ALL questions in Section A.	/55 Marks
Answer THREE questions in Section B.	/30 Marks
Section C is Compulsory.	/15 Marks

SECTION A: Attempt all questions in this section. /55 Marks

1. (a) What is the complementary RNA base sequence for G A T C A A? **(1mark)**

   (b) From the molecules below:
   Amino Acids, Nucleotide, Lipids and Water

   (i) Choose the molecule that is most abundant in the cells of the human body. **(1mark)**

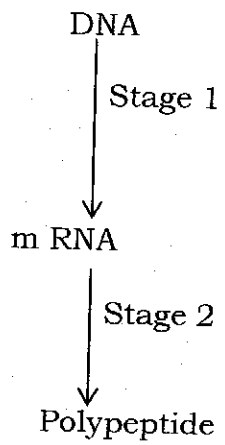
   (ii) Choose the molecule that contains most energy. **(1mark)**

2. Copy and complete the table below which gives information about three types of mammalian blood cells.

Appearance of blood cell	Name of blood cell	Function
A 		
B 		Makes antibodies
C 		Phagocytosis

3. (a) Proteins have many roles in humans, for example, in defence against disease. Give an example of such a protein. **(1mark)**

   (b) The diagram below outlines protein synthesis in a cell



   (i) Name stages 1 and 2 **(2marks)**

(ii) Where does stage 2 take place within a cell? **(1mark)**
(iii) Describe the role of tRNA in stage 2. **(3marks)**

4. (a) What is the difference between absorption and assimilation? **(2marks)**

(b) Red blood cells transport oxygen from lungs to respiring tissues and carbondioxide from respiring tissues to lungs. How is their structure suited to that function? **(3marks)**

5. Which blood vessel in humans has:
(a) The highest pressure ? **(1mark)**
(b) The highest oxygen concentration? **(1mark)**
(c) The highest Carbondioxide concentration? **(1mark)**
(d) The highest concentration of glucose following a meal? **(1mark)**

6. (a) How can the body gain heat? **(3marks)**
(b) How can subcutaneous fat help in temperature control? **(2marks)**

7. Describe the role of the hormone FSH and LH in the control of menstrual cycle. **(2marks)**

8. Suggest why there are no blood capillaries in the cornea of the eye. How is the cornea supplied with its requirements? **(3marks)**

9. (a) The plant makes complex food compounds which may be used for energy, growth, repair and reproduction. Give four examples of such food compounds. **(2marks)**

(b) Before testing for starch the leaf is warmed in ethanol. The ethanol turns green. Why is this ? **(2marks)**

10. (a) Insulin can not effectively be taken by mouth. Why is this so? **(2marks)**

(b) Suggest how people with diabetes can control their blood glucose level. **(2marks)**

11. Explain how the structure of a mitochondria is adapted to its function in aerobic respiration. **(3marks)**

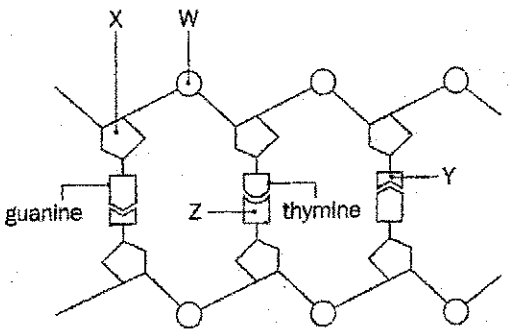
12. (a) In a fruit fly, the gene for red eye colour (R) is dormant to the gene for white eye colour (r). The trait is sex-linked. What would be the genotype of a white-eyed female? **(2marks)**

(b) A man with blood group B marries a woman with blood group AB. Indicate the type of blood group their children will not have. Show your working. **(2marks)**

13. Many organisms require glucose as a respiratory substrate. Explain how each of the following obtain glucose.

(a) Saprobiotic fungus **(2marks)**
(b) An embryo in a germinating seed **(2marks)**
(c) An implanted mammalian blastocyst. **(2marks)**

14. The diagram below show a part of a DNA molecule.



What do each of the following letters on the diagram represent?

W.....
X.....
Y.....
Z..... **(4marks)**

SECTION B: Attempt any THREE questions /30 Marks

15. (a) Explain why variation caused by the environment can not be passed from an organism to its offspring. **(5marks)**

(b) A cell with 3 sets of chromosomes is said to be triploid, 3n. A cell with 4 sets of chromosomes is said to be tetraploid, 4n. Could meiosis take place in a 3n or 4n cell? Explain your answer. **(5marks)**

16. The table below shows the cell composition of three samples of blood.

	Sample from		
Cell count No. per mm^3	Peter	John	Joseph
Red blood cells	6.000.000	5.000.000	2.000.000
White blood cells	500	6.000	5.000
Platelets	200.000	220.000	500

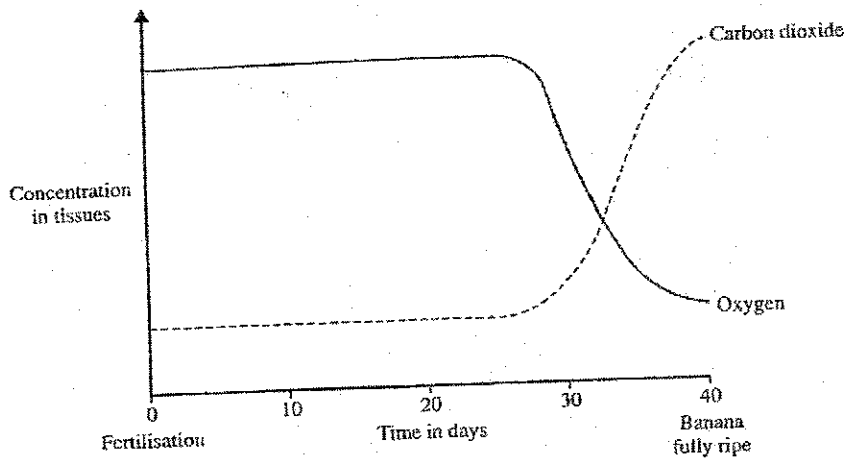
(a) Which person is most likely to have lived at high altitude recently? Explain your answer. **(2marks)**

(b) Which person would be the most likely to become ill if exposed to a virus? Explain your answer. **(2marks)**

(c) Which person's blood is least likely to clot efficiently if injured? Explain your answer. **(2marks)**

(d) Describe the mechanism of blood clotting. **(4marks)**

17. (a) The graph below shows the concentration of Oxygen and Carbondioxide in the tissues of a banana fruit as it ripens



(i) Through which plant tissue are carbohydrates produced by photosynthesis in the leaves transported to the cells in the fruit? **(1mark)**

(ii) Suggest how oxygen from the atmosphere reaches the cells in the fruit? **(2marks)**

(iii) Explain the relationship between the concentration of oxygen and carbondioxide over the period shown on the graph. **(2marks)**

(b) The respiratory quotient (RQ) of a banana fruit at 10 days was 0.8. At 40 days it was 1.0.

(i) Suggest what caused the change in respiratory quotient over this period. **(2marks)**

(ii) Suggest a method by which you could use a simple bichemical test to measure the amount of reducing sugar in samples of banana fruits. **(3marks)**

18. (a) Explain what is meant by the following terms:

(i) A density - dependent factor
(ii) A density - independent factor
(iii) Intraspecific competition
(iv) Interspecific competition **(4marks)**

(b) A predator is an animal which kills another animal, a prey for food. What qualities do you think a predator should have in order to kill the prey and what should the prey do to avoid being killed. **(6marks)**

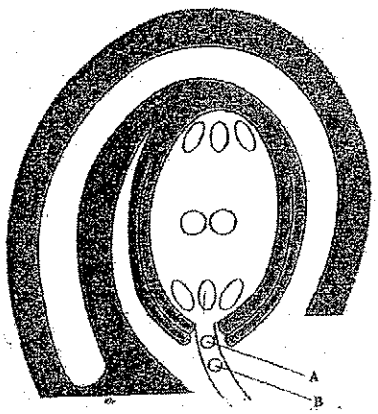
19. (a) Describe the various sources of variation

(b) What is meant by the term point mutation? **(10marks)**

SECTION C: This section is compulsory.

20. (a) Describe the similarities and differences between male and female gametes. **(3marks)**

(b) The diagram below shows a pollen tube entering the ovule of a flowering plant.



Explain why gametes A and B are genetically identical to each other but differ from each other's male gametes produced by this plant. **(6marks)**

(c) (i) Explain how a developing plant embryo gains its nutrients from the food reserve in the seed. **(3marks)**

(ii) Explain two ways in which the placenta is adapted to provide a developing mammalian fetus with its nutrients. **(3marks)**

Biology I

013

18 Nov. 2005 8h30 – 11h30 am

RWANDA NATIONAL EXAMINATIONS COUNCIL

P.O. BOX 3817 KIGALI-TEL/FAX : 586871

NATIONAL EXAMINATION 2005

SUBJECT : BIOLOGY I

OPTION : BIOLOGY-CHEMISTRY

DURATION : 3 HOURS

INSTRUCTIONS :

Answer ALL questions in Section A.

Three questions in Section B and only ONE in Section C.

SECTION A : Attempt all questions in this Section. **(55Marks)**

1. (a) In what part of a Eukaryotic cell does DNA replication take place? **(1mark)**

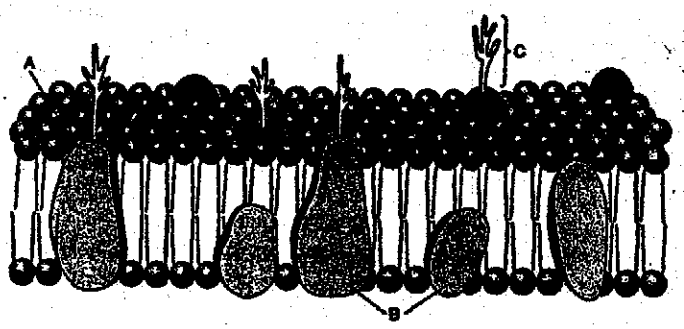
   (b) What other types of molecules apart from nucleotides are needed for DNA replication to take place. **(2marks)**

2. Testudo ephippum is one of the species of large tortoise. Complete the table below to show its classification.

KINGDOM	ANIMALIA
----------	Chordata
----------	Reptilia
----------	Chelonia
Family	Testudinidae
Genus	----------
----------	----------

(3marks)

3. The diagram below shows the structure of a cell surface membrane.



   (a) Name the structures labeled A, B and C

   A----------
   B----------
   C---------- **(3marks)**

   (b) Explain how the properties of phospholipids are important in the formation of membranes. **(2marks)**

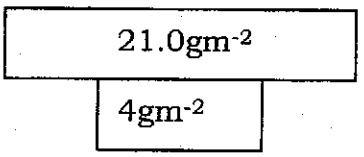
4. (a) Cells in the pancreas produce enzymes. These cells are associated with large amounts of rough endoplasmic reticulum and golgi bodies. Explain why. **(3marks)**

(b) What does Q10 mean with respect to enzyme reaction? **(2marks)**

5. (a) Small organisms do not need a circulatory system like large organisms.
Why do large organisms need a circulatory system? **(2marks)**

(b) Mammals have a double circulation. What does this mean? **(2marks)**

6. The diagram below shows an inverted pyramid of biomass.



Animal planktons

plant planktons.

Suggest a reason for this inversion. **(2marks)**

7. Downs syndrome can be caused by non-disjunction. Explain the term non-disjunction and describe how it causes Downs syndrome. **(4marks)**

8. Two groups of enzymes digest proteins. They are called endopeptidases and exopeptidases. Explain exactly what these enzymes do.
Which group is secreted first and why? **(6marks)**

9. (a) Name the factors that make malaria a difficult disease to control. **(3marks)**

(b) Explain why there is a high risk of cholera in refugee camps. **(2marks)**

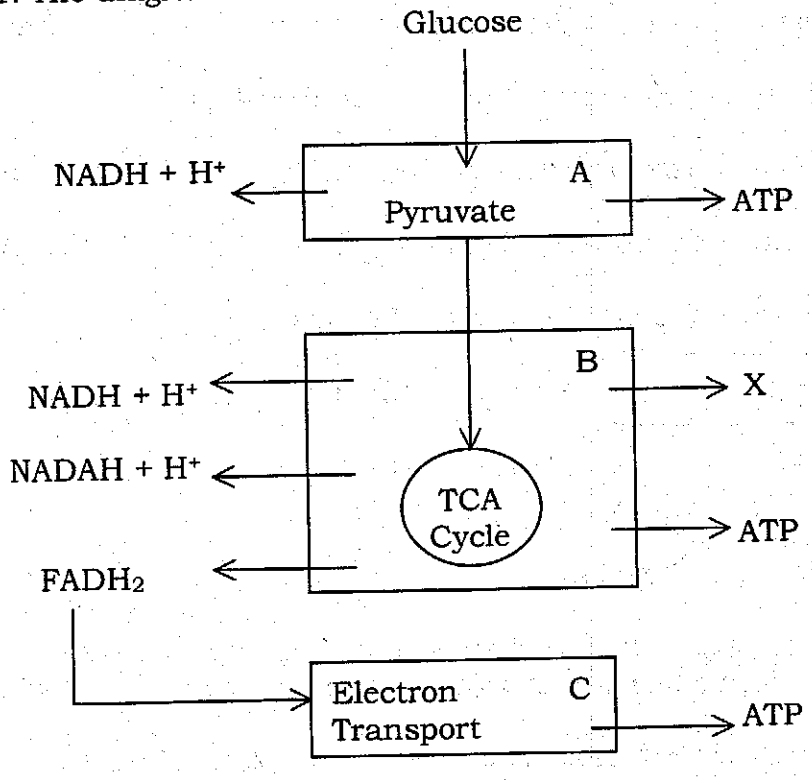
10. The table below show the core temperature of two animals at various times on a hot sunny day. Animal A was allowed to drink water, but animal B was deprived of water.

Time of day	Core temperature /°C	
	Animal A	Animal B
9.00	36,0	34,8
12.00	37,7	38,6
15.00	39,2	40,1
24.00	35,8	37,0

(a)(i) Explain why the body temperature of animal A does not rise as high as that of animal B. **(2marks)**

(ii) Explain how the body temperature of animal B is controlled. **(2marks)**

11. The diagram below shows the main stages of aerobic respiration.



(a) State precisely where reactions in boxes A, B and C occur in the cell.

A ----------
B ----------
C ---------- **(3marks)**

(b) Name substance X ---------- **(1mark)**

(c) A total of 38 molecules of ATP are produced during the complete break down of one molecule of glucose. State how many molecules of ATP formed at each stages A, B and C.

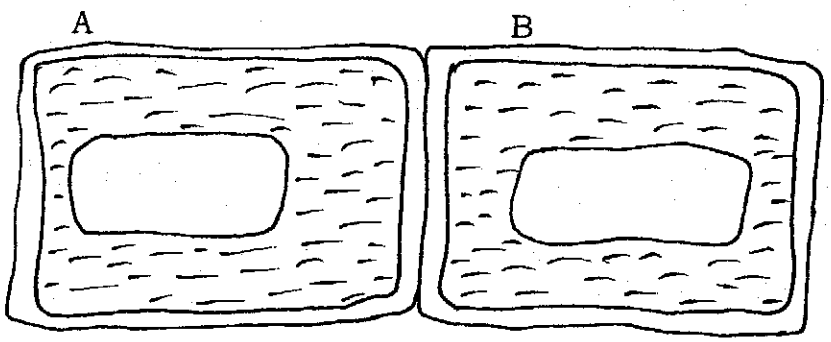
A ----------
B ----------
C ---------- **(3marks)**

12. Flowering plants reproduce both sexually and asexually. What are the advantages of this to such plants. **(4marks)**

13. You have a solution which you know contains sugar but you do not know whether it is a reducing sugar, non-reducing sugar or a mixture of both. How can you find out. **(3marks)**

SECTION B: Answer any THREE question only. (30 Marks)

14. Two neighbouring plant cells are shown in the diagram.



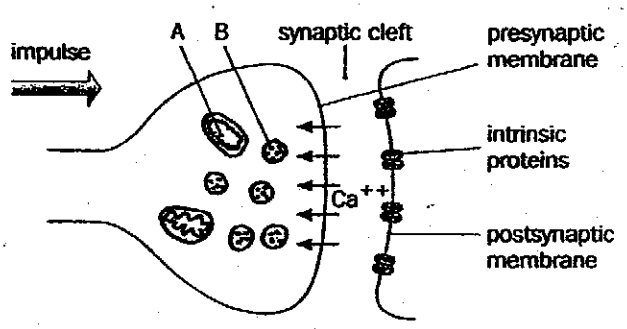
Ψ= -200kPa Ψ= 400 kPa

(a) In which direction would there be a net movement of water molecules. **(1mark)**

(b) Explain what is meant by net movement? **(2marks)**

(c) Explain what would happen if both cells were placed in
(i) Pure water.
(ii) One molar sugar solution (Ψ=-3500 kPa) **(7marks)**

15. (a) Name the following structures in the synapse



(i) Structure A
(ii) Structure B
(iii) The contents of structure B. **(3marks)**

(b) The arrival of an impulse changes the permeability of the presynaptic membrane, allowing calcium ions to diffuse in as shown by the arrows on the diagram. Describe the effect caused by this influx of ions. **(2marks)**

(c) Explain fully why structure A is found abundantly in the presynaptic region. **(5marks)**

16. (a) Suggest why the true total of AIDS cases world wide may be much higher than reported. **(2marks)**

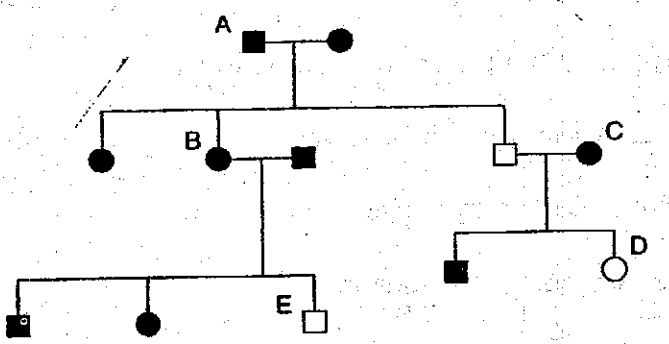
(b) Suggest why condoms are NOT fully effective at preventing HIV infection. **(2marks)**

(c) What types of advice can you offer as part of an AIDS education programme. **(6marks)**

17. (a) Define the term mutation. **(1mark)**

(b) Describe briefly the types of mutations. **(4marks)**

(c) Red-green colour blindness is sex-linked recessive condition. The gene for colour blindness is carried on the X chromosome. The figure below shows a family tree. Work out the genotypes of the individuals labelled A-----E. **(5marks)**



18. (a) Active transport and osmosis are two main ways by which substances move in and out of cells. Give two differences between these processes. **(2marks)**

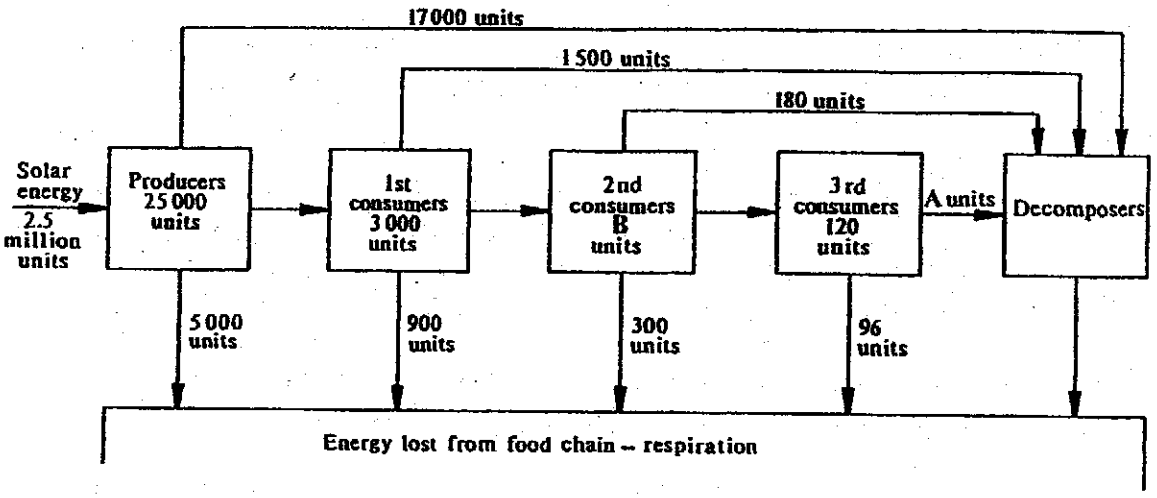
(b) Explain the part played by active transport and osmosis in each of the following:-

(i) The uptake of substance from the soil by roots. **(4marks)**

(ii) Selective reabsorption in the proximal convoluted tubule of a nephron. **(4marks)**

SECTION C: Answer ONE question only. (15 Marks)

19. The diagram below shows the flow of energy through the organisms at different feeding levels in a habitat.



(a) What percentage of the solar energy falling on the habitat is trapped by the producers. **(1mark)**

(b) Study the diagram and then calculate the missing energy values A and B.

(i) A ----------

(ii) B ---------- **(2marks)**

(c) In this habitat the 1st consumers are small invertebrates such as snails, earthworms and insects. The 3rd consumers are foxes and hawks.

(i) Examine the proportion of their total energy intake used in respiration by the 1st and 3rd consumers. Which uses the greater proportion. Show your working. **(4marks)**

(ii) Suggest the explanation for the difference in these proportion considered in part C(i) above. **(4marks)**

(iii) There are only five feeding levels in this habitat. Suggest why we can not have a sixth feeding level. **(4marks)**

20. (a) In a human cell, there are 46 chromosomes. Which part of the cell contain chromosomes. **(1marks)**

(b) Humans reproduce by sexual reproduction. Suggest two reasons why human bodies do not grow up to look exactly like either of their parents. **(3marks)**

(c) (i) A person's sex is determined by their sex chromosomes. Explain why it is impossible for identical twins to be a girl and a boy. **(3marks)**

(ii) Cloning is an artificial process to produce offsprings which are genetically identical to their parents. Suggest some of the potential problems with reproducing animals by this method. **(4marks)**

(d) Some farmers use selective breeding to try to improve the characteristics of future generations of livestock.

(i) Describe briefly the process of selective breeding and its importance. **(4marks)**

RWANDA NATIONAL EXAMINATIONS COUNCIL

B.P. 3817 KIGALI - TEL/FAX : 586871

Biology II

015

08 Oct 2004 8h30 – 11h30

NATIONAL EXAMINATION 2003/2004

SUBJECT : BIOLOGY II

OPTIONS : MATHS – PHYSICS
: NPA

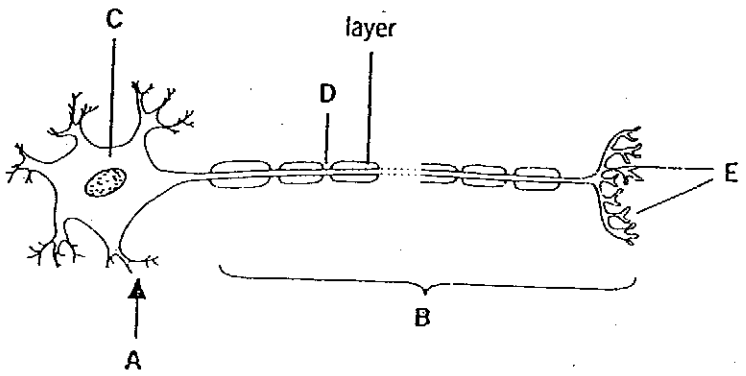
DURATION : 3 HOURS

INSTRUCTIONS :

Answer ALL questions in Section **A**.
THREE questions in section **B** and only ONE in Section **C**.

SECTION A: Answer all questions in this section /55 Marks.

1. The diagram below shows a mammalian neurone.



(a) What type of neurone is shown? **(1mark)**

(b) Name the parts labelled A, B, C and D.

A:
B:
C:
D:

(2marks)

(c) (i) Suggest two reasons why the fibre is surrounded by a fatty layer. **(2maks)**

(ii) Name the fatty layer. **(1mark)**

2. (a) The molecules listed below may be found in eukaryotic cells.

- Glycogen
- Glycoprotein
- Histones
- Cytochrome
- Phospholipids
- RNA
- DNA

Choose two of the molecules listed above that would normally be found in:-

(i) the cell membrane

(ii) a chromosome

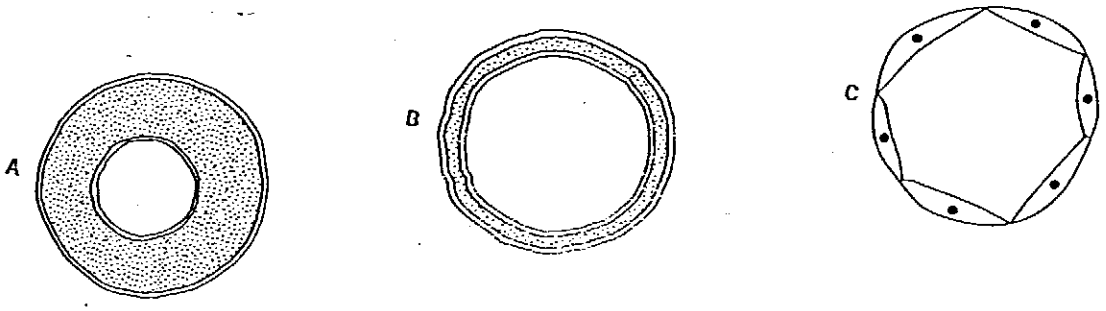
(4marks)

(b) Explain the biological significance of the following.

(i) The nuclear envelope has many pores on its surface.

(ii) The membrane of some cells is folded into microvilli. **(2marks)**

3. The diagrams below show three types of blood vessels in transverse section.



(a) Name the blood vessels.

A:

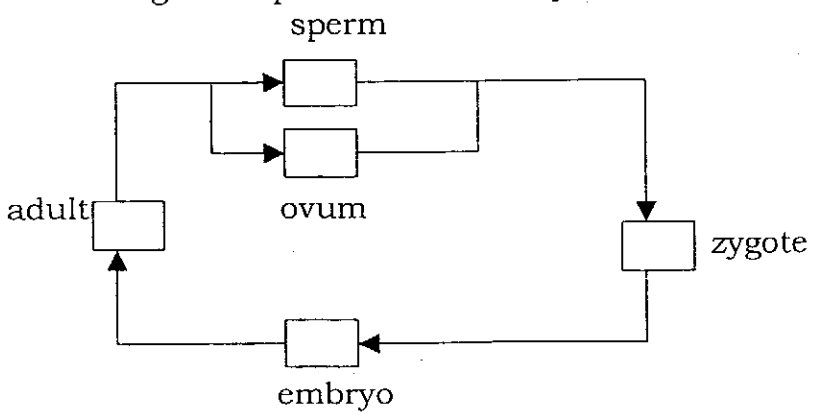
B:

C: **(2marks)**

(b) Describe the roles of vessel C. **(1mark)**

(c) Describe two ways that vessel C is adapted for its function. **(2marks)**

4. The diagram represents the life cycle of the arctic fox (2n = 52)



(a) Complete this diagram by writing in the boxes the number of chromosomes present at each stage. **(2marks)**

(b) The arctic fox is able to breed with the red fox (2n = 34). The offsprings, however, are 2n = 43 which makes them infertile. Suggest why this chromosome number makes the offspring infertile. **(2marks)**

5. (a) Name the region of the kidney in which the renal capsule are found. **(1mark)**

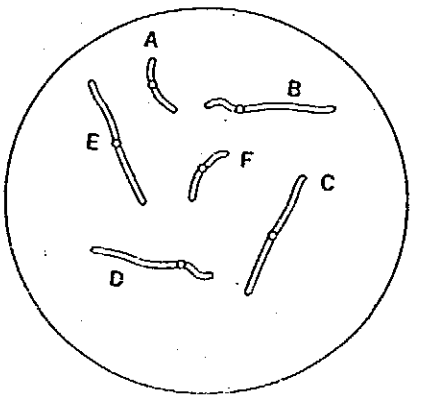
(b) Describe the process of ultrafiltration. **(3marks)**

6. The table below refers to the structure of different types of nucleic acids. If the feature is present place a (✓) in the appropriate box and if the feature is absent place a cross (×) in the appropriate box.

FEATURE.	DNA	m RNA
Cytosine present.		
Uracil present.		
Pentose Sugar present.		
Is single stranded.		

(4marks)

7. The diagram below shows the chromosomes in the nucleus of a cell.



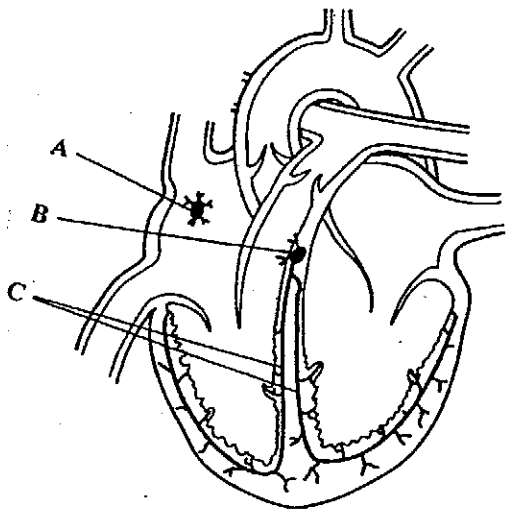
(a) (i) Give the letters of one pair of homologous chromosomes. **(1mark)**

(ii) Draw the diagrams to show the arrangement of chromosomes at Metaphase 1 and Metaphase 2 of the above cell. **(4marks)**

8. Define the following biological terms.
   (a) Pollination
   (b) Protandry **(1mark)** **(2marks)**

9. (a) Cardiac muscle contract myogenically. Explain what is meant by the term Myogenic. **(1mark)**

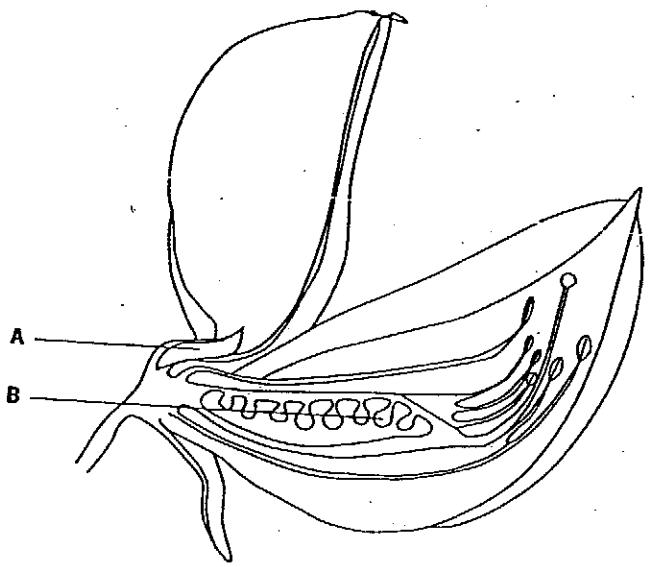
(b) The diagram below shows structures in the heart which are concerned with the coordination of contraction.



(i) Name the parts A, B and C
A----------
B----------
C---------- **(3marks)**

(ii) Explain how the structures shown in the diagram coordinate the contraction of the heart. **(3marks)**

10. The diagram below shows a vertical section of a flower.



(a) State one function for each of the parts labelled A and B. **(2marks)**

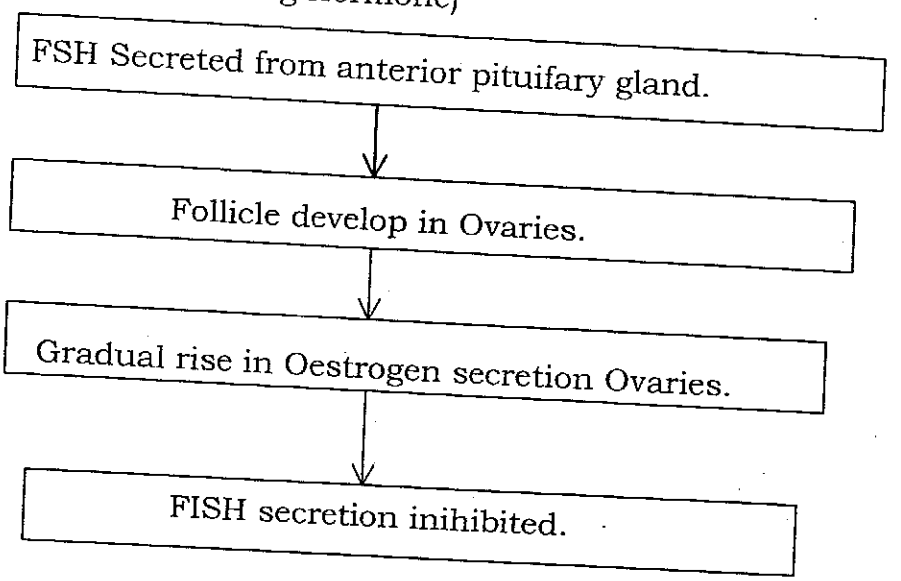
(b) This flower is insect-pollinated. Describe three features visible on the diagram, which are characteristic of insect-pollinated flowers.

(3marks)

(c) State one similarity between a human sperm and a male gamete of a flowering floweer.

(1mark)

11. The diagram below shows some of the effects that follow the secretion of FSH (Follicle Stimulating Hormone)



(a) State the type of mechanism, shown by the diagram, that controls the secretion of FSH and Oestrogen.

(1mark)

(b) Explain why hormones, such as FSH and Oestrogen, only affect the activity of specific target organ.

(2marks)

(c) With reference to the differnces between nervous and hormonal coordination, suggest why the development of the follicle is coordinated by hormones and not by the nervous system.

(2marks)

SECTION B: **/30 Marks**

Answer any THREE questions only.

12. (a) With reference to example explain what is meant by each of the following terms.

(i) Continuous variation. **(2marks)**

(ii) Discontinuous variation. **(2marks)**

(b) Variation can arise by point mutations.

(i) Describe two types of point mutation which could result in the change of a GCT codon to a GCA codon. **(2marks)**

(ii) Suggest why such a point mutation might have no effect on the phenotype. **(2marks)**

(c) Variation occurs in humans in their ability to detect sound. Two unlinked genes, each with two alleles (A and a, B and b) affect hearing in humans. A person who is homozygous recessive for either or both of these genes is deaf. A couple have the genotype Aabb and aaBb. Using a genetic diagram determine the probability that a child produced by them will have a normal hearing. **(2marks)**

13. (a) Describe how sex is determined in humans. **(3marks)**

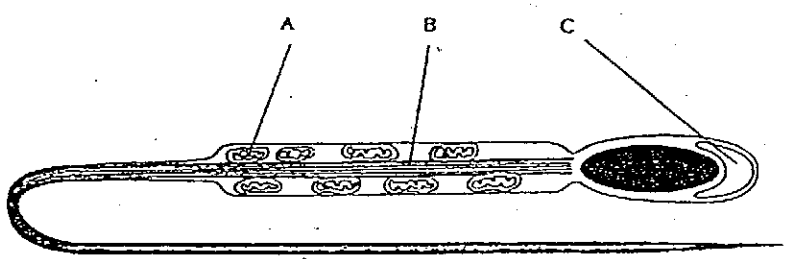
(b) The flow diagram below shows the sequence in spermatogenesis leading to the formation of spermatozoa.

Cell A
↓
Primary spermatocyte
↓
Secondary spermatocyte
↓
Spermatid
↓
Spermatozoan

(i) Name cell A **(1mark**

(ii) Indicate on the flow diagram where the second division of meiosis occurs. **(1mark**

(c) The diagram below shows the structure of a spermotozoon.



Name the parts labelled A, B and C

A:

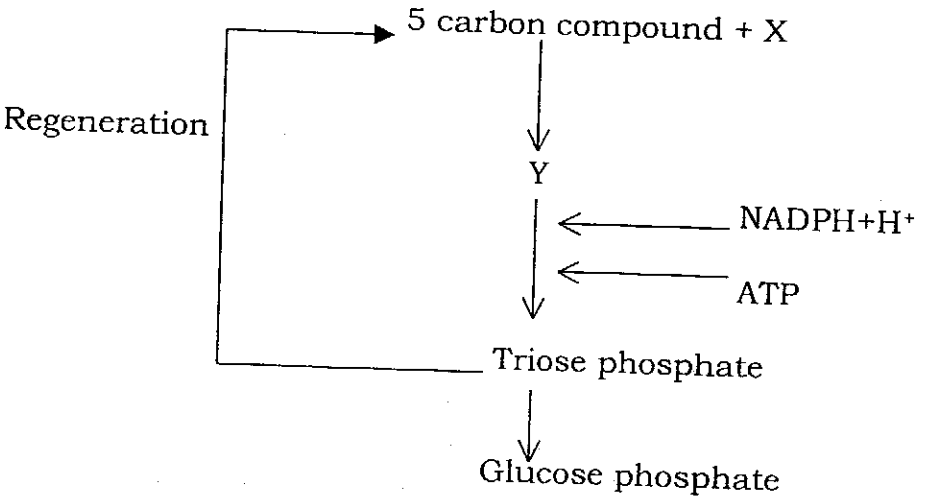
B:

C: **(2marks)**

(d) Describe how the spermatozoa are transfered into the female. **(5marks)**

14. (a) The rate of photosynthesis can be limited by a number of factors. Explain why temperature can be a limiting factor in photosynthesis. **(2marks)**

(b) The flow diagram below shows some of the processes which occur in the light-indipendent reaction of photosynthesis.

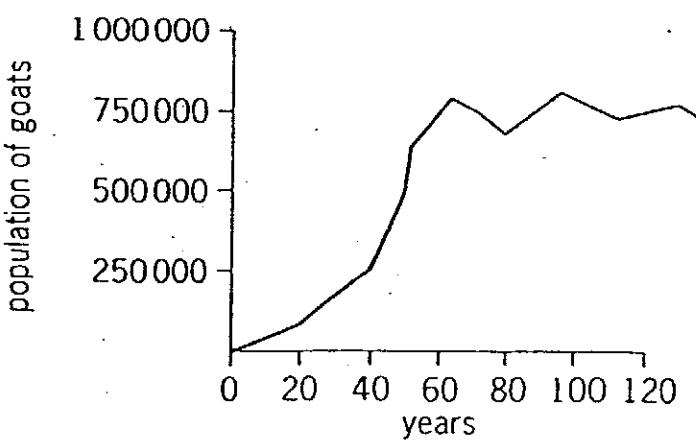


(i) Name the substances represented by X and Y. **(2marks)**

(ii) State the origin of the NADPH+H+ and ATP used in the light-independent reaction. **(1mark**

(c) Describe how the products of photosynthesis are transported in the plant. **(5marks)**

15. A type of wild goat was introduced into an Island and they bred successfully. The following graph shows the number of wild goat population over the period of 120 years after their first introduction to the Island.



(a) Describe the pattern of population change shown in the graph. **(3marks)**

(b) (i) Define what is meant by the 'carrying capacity'. **(1mark)**

(ii) What is the carrying capacity for the Island with respect to goats? **(1mark)**

(iii) Name two factors which might limit the size of the Island's carrying capacity for goats. **(2marks)**

(iv) Are factors named in (iii) above density dependent or density independent? **(1mark)**

(v) Explain what is meant by the term density independent factor. **(2marks)**

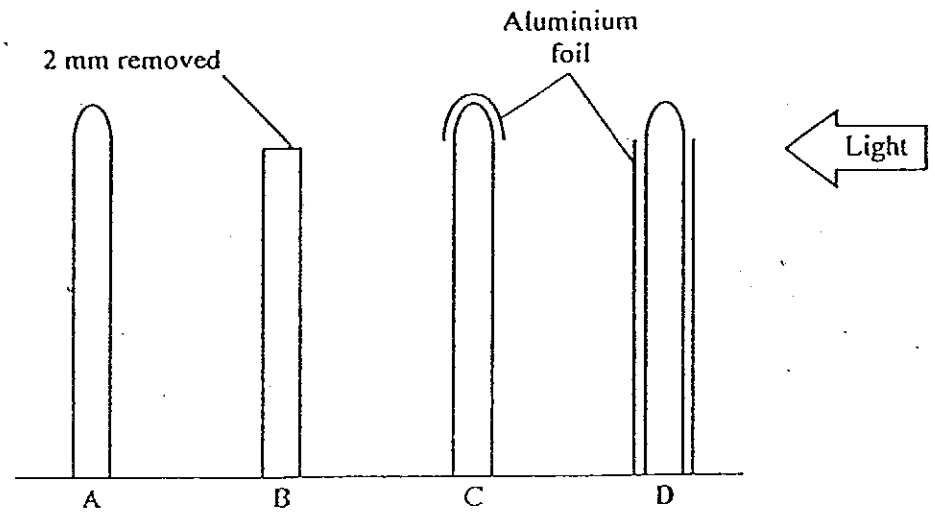
16. (a) Explain how ultrafiltration and reabsorption remove urea from the blood without losing essetial nutrients such as protein and glucose. **(5marks)**

(b) Explain the part played by the loop of Henle and the collecting duct in concentrating Urine in a healthy individual. **(5marks)**

SECTION C: **/15 Marks.**

Answer only ONE question.

17. The diagram shows four Oat seedlings which have been set up to investigate their response to light coming from one side.



(a) How would you arrange for the seedlings to receive light from one side only? **(2marks)**

(b) The seedlings were left for days with light coming from the side as shown in the diagram.

(i) Describe what would happen to the height of each of these seedlings. **(2marks)**

(ii) Describe the direction of the growth movement of each seedling after this time.

Seedling A
Seedling B
Seedling C
Seedling D

(4marks)

(c) Which part of the Oat seedling detects the direction from which the light is shining?

(d) (i) What is the name given to the growth movement of plants in response to light? **(1mark)**

(ii) Explain how this growth response in the shoot is caused. **(5mrks)**

18. There are four alleles of a gene that determine coat colour in rabbits. The alleles are not sex linked.

(a)(i) State the term used to describe these alleles. **(2marks)**

(ii) The alleles for normal colour, R, is dominant to all the other alleles. The allele for albino, r, is recessive to all the other alleles. The allele for Chinchilla, r^{ch} is dominant to himalayan, r^{h}. State the phenotype of the following genotypes.

- Rr^{ch}
- $r^{ch}r^{ch}$
- $r^{ch}r$

(3marks)

(iii) Draw a genetic diagram to show the expected results of a cross between a homozygous chinchilla male and a heterozygous himalayan female. Exaplain your results. **(6marks)**

(b) In the wild, rabbits have a high reproductive rate. Explain why such over production is necessary. **(4marks)**