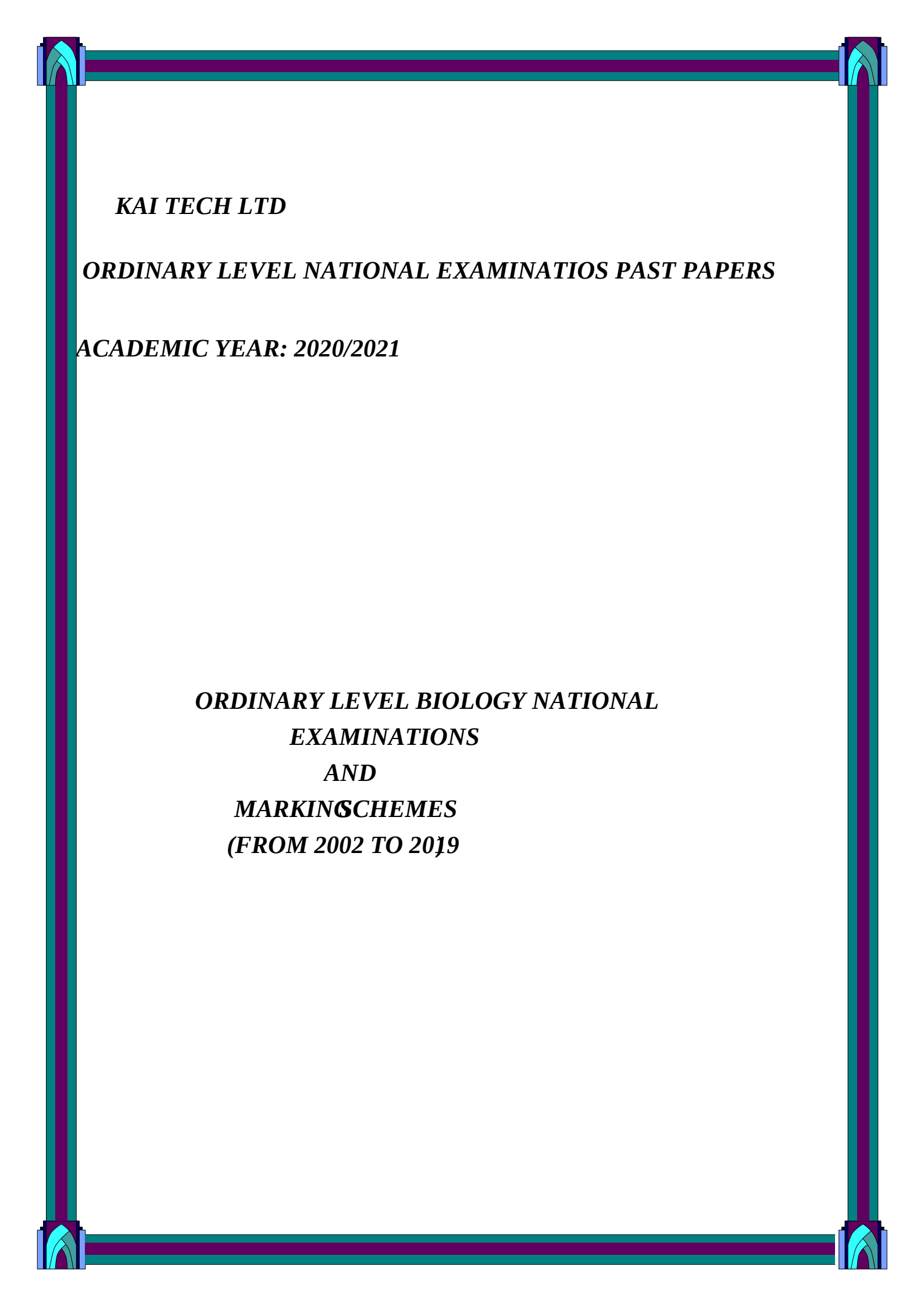




KAI TECH LTD

ORDINARY LEVEL NATIONAL EXAMINATIONS PAST PAPERS

ACADEMIC YEAR: 2020/2021

***ORDINARY LEVEL BIOLOGY NATIONAL
EXAMINATIONS
AND
MARKING SCHEMES
(FROM 2002 TO 2019)***

TABLE OF CONTENTS

TABLE OF CONTENTS.....	2
ORDINARY LEVEL NATIONAL EXAMINATION 2001/2002	6
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2001/2002	12
ORDINARY LEVEL NATIONAL EXAMINATION 2002/2003	17
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2002/2003	22
ORDINARY LEVEL NATIONAL EXAMINATION 2003/2004	28
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2003/2004	32
ORDINARY LEVEL NATIONAL EXAMINATION 2005	38
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2005	45
ORDINARY LEVEL NATIONAL EXAMINATION 2006	49
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2006	54
ORDINARY LEVEL NATIONAL EXAMINATION 2007	59
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2007	64
ORDINARY LEVEL NATIONAL EXAMINATION 2008	71
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2008	76
ORDINARY LEVEL NATIONAL EXAMINATION 2009	83
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2009	87
ORDINARY LEVEL NATIONAL EXAMINATIONS 2010	94
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2010	100
ORDINARY LEVEL NATIONAL EXAMINATIONS 2011	107
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2011	112
ORDINARY LEVEL NATIONAL EXAMINATIONS 2012	119
MARKING OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2012	128
ORDINARY LEVEL NATIONAL EXAMINATIONS 2013	134
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2013	139
ORDINARY LEVEL NATIONAL EXAMINATIONS, 2014	145
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2014	151
ORDINARY LEVEL NATIONAL EXAMINATIONS, 2015	157
MARKING OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2015	163
ORDINARY LEVEL NATIONAL EXAMINATIONS, 2016	170
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2016	175
ORDINARY LEVEL NATIONAL EXAMINATIONS, 2017	181
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2017	171
ORDINARY LEVEL NATIONAL EXAMINATIONS, 2018	179
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2018	184
ORDINARY LEVEL NATIONAL EXAMINATIONS, 2019	191
MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2019	197

Top 10 study tips

1. Have all your materials ready before you begin studying: pencils, pens, papers, calculators if necessary etc.

2. Be positive. Make sure your brain holds on to the information you are learning by reminding yourself how important it is to remember the work and get the marks.
3. Take a walk outside. A change of scenery will stimulate your learning. You'll be surprised at how much more you take in after being outside in the fresh air.
4. Break up your learning sections into manageable parts. Trying to learn too much at one time will only result in a tired, unfocused and anxious brain.
5. Keep your study sessions short but effective and reward yourself with short, constructive breaks.
6. Teach your concepts to anyone who will listen. It might feel strange at first, but it is definitely worth reading your revision notes aloud.
7. Your brain learns well with colours and pictures. Try to use them whenever you can.
8. Be confident with the learning areas you know well and focus your brain energy on the sections that you find more difficult to take in.
9. Repetition is the key to retaining information you have to learn. Keep going – don't give up!
10. Sleeping at least 8 hours every night, eating properly and drinking plenty of water are all important things you need to do for your brain. Studying for exams is like strenuous exercise, so you must be physically prepared.

Question words to help you answer questions

It is important to look for the question words (the words that tell you what to do) to correctly understand what the examiner is asking. Use the words in the table below as a guide when answering questions.

Question word	What is required of you
Analyse	This means a numerical answer is required – in general, you should show your working, especially where two or more steps are involved
Classify	Group things based on common characteristics
Compare	Point out or show both similarities and differences between things, concepts or phenomena
Define	Give a clear meaning
Describe	State in words (using diagrams where appropriate) the main points of a structure / process / phenomenon / investigation.
Determine	To calculate something, or to discover the answer by examining evidence
Differentiate	Use differences to qualify categories

Discuss	Consider all information and reach a conclusion
Explain	Make clear; interpret and spell out

Identify	Name the essential characteristics
Label	Identify on a diagram or drawing
List	Write a list of items, with no additional detail
Mention	Refer to relevant points
Name	Give the name (proper noun) of something
State	Write down information without discussion
Suggest	Offer an explanation or a solution
Tabulate	Draw a table and indicate the answers as direct pairs

“If you can’t explain it simply, you don’t understand it well enough.”
Albert Einstein

On the day of the exam ...

1. Make sure you have all the necessary stationery for your exam, i.e. pens, pencils, eraser, protractor, compass, calculator (with new batteries). Make sure you bring your ID document and examination admission letter.
2. Arrive on time, at least one hour before the start of the exam.
3. Go to the toilet before entering the exam room. You don’t want to waste valuable time going to the toilet during the exam.
4. Use the 10 minutes reading time to read the instructions carefully.
5. This helps to ‘open’ the information in your brain. Start with the question you think is the easiest to get the flow going.
6. Break the questions down to make sure you understand what is being asked. If you don’t answer the question properly you won’t get any marks for it. Look for the key words in the question to know how to answer it. A list of these words is on page above of this booklet. Try all the questions. Each question has some easy marks in it so make sure that you do all the questions in the exam.
7. Never panic, even if the question seems difficult at first. It will be linked with something you have covered. Find the connection.
8. Manage your time properly. Don’t waste time on questions you are unsure of. Move on and come back if time allows.
9. Check weighting – how many marks have been allocated for your answer? Do not give more or less information than is required.
10. Write big and bold and clearly. You will get more marks if the marker can read your answer clearly.

Source: Alfie Bouwer, Sivalingam Chetty et al; 2014, *Mind the gap, Life sciences study guide grade 12*, Department of basic education, Pretoria, South Africa.

Note: Through the questions herein are fully answered, it is highly recommended that you first read and understand the question, make

your trials and then compare with what is given in the solution. It is also advisable that you read through the book several times before the final examinations.

I am certain that if a student can answer all these questions in this document with ease, he/she should be able to pass with a distinction in the ordinary level national biology examination.

The pdf file was and remains free for everybody to read, store and print for personal use, and to distribute electronically, but only in non-modifiable form and at no charge. Duplication of this material for student in-class use or for examination purposes is permitted without written approval.

“ Everyone is a genius. But if you judge a fish by its ability to climb

a tree, it will spend its whole life believing that it is stupid. ”
Albert Einstein

“Never say you have failed until you have reached your last attempt, and never say it's your last attempt until you have succeeded. ”

“ There are no secrets to success. It's all about preparing, hard work and learning from failure. ”



P.O.BOX, 3817 KIGALI-TEL/FAX : 86871

BIOLOGY III

017

07th Nov. 2002 08.30am –11.30am

ORDINARY LEVEL NATIONAL EXAMINATION 2001/2002

SUBJECT: BIOLOGY III

LEVEL: TRONC COMMUN /ORDINARY LEVEL S3

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A**, **B** and **C**

Answer **ALL** questions in section A. **(55 marks)**

Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

SECTION A: ANSWER ALL QUESTIONS**(55 MARKS)**

1. What materials are to be supplied to cells if they are to survive? **(2 marks)**
2. What features are (a) Possessed by both plants and animals? **(2 marks)**
(b) Possessed by plants only? **(2 marks)**
3. A motor car can move, takes in oxygen and gives out carbon dioxide, consumes fuel but nevertheless is not a living organism. In what ways does it not qualify as a living organism? **(2 marks)**
4. How do roots and leaves obtain oxygen for respiration? **(2 marks)**
5. a) Where does respiration occur? **(1 mark)** b) What is the importance of respiration? **(1 mark)**
c) What are the products of respiration? **(1 mark)**

6. a) Draw a line to link the name of the life process with its meaning. One is done for you. **(3 marks)**

Life process	Meaning
Reproduction	changing the position of a part or all of the body.
Growth	Responding to the environment
Movement	Producing fertile off springs
Sensitivity	Getting larger or more developed.

- b) The following are parts of an organism: Cell, organ, chromosome, system, gene, tissue. Arrange them in decreasing order of size.

Largest

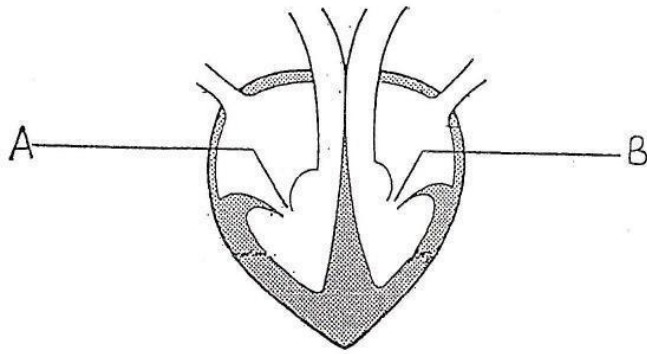


Smallest

(3 marks)

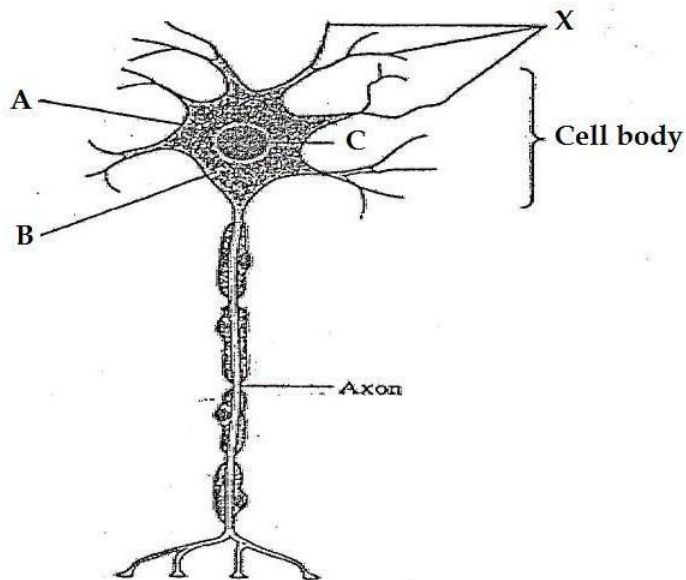
7. In what ways does a dicotyledonous leaf adapt itself to its function? **(2 marks)**
8. What are the requirements for photosynthesis? How are the requirements met in land plant? **(3 marks)**
9. What is the importance of bacteria to man? **(2 marks)**

10. The diagram below represents the structure of the heart.



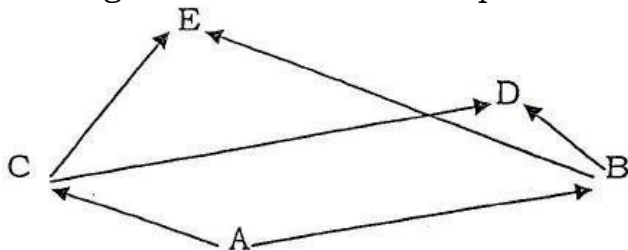
- a) Use an arrow to indicate the direction of blood flow through the heart. **(1 mark)**
- b) What are the functions of parts A and B? **(2 marks)**
- c) Why do ventricles have thicker muscular walls than atria? **(2 marks)**

11. The diagram below shows a motor neurone (a nerve cell)



- a) Name structures A, B and C. **(3 marks)**
- b) Suggest the function of X. **(1 mark)**
- c) Draw an arrow on the diagram to show the direction of a nerve impulse. **(1 mark)**

12. The diagram below shows a simple food web.



- a) Use the diagram to name.
- i) A Herbivore **(1 mark)** ii) An Omnivore **(1 mark)** iii) A producer **(1 mark)**
- b) i) The animals in the food web get their energy from the food they eat.

From where does A get its energy? **(1 mark)** ii) Draw a pyramid of energy for the following food chain. **(2 marks)**



13. The chromosome for determining the gender or sex of a person are labelled X and Y.

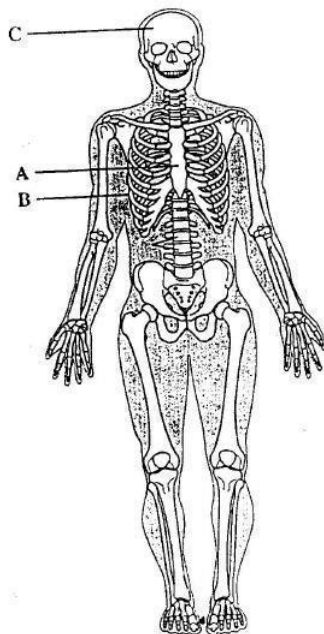
	(X) PARENT 1 (X)	
(X) PARENT 2 ()	—	—
	—	—

a) Complete the Punnett square to show the genotype of parent 2 and of the offspring. **(3 marks)**

b) Which parent is the mother? **(1 mark)**

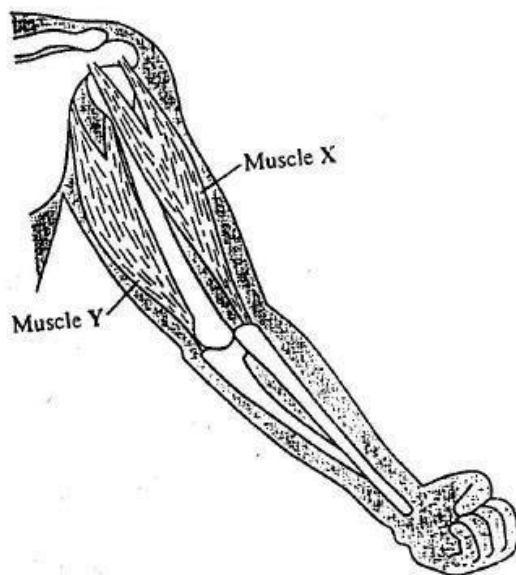
c) What are the chances of getting a baby boy? **(1 mark)**

14. a) The diagram below shows the human skeleton. Humans have a bonny endoskeleton.



i) Name the structures labelled A and B. **(2 marks)** **ii)** What is the function of Part C? **(1 mark)** **b)** Give the name of one animal which has an exoskeleton. **(1 mark)**

c) The diagram below shows bones and some of the muscles in a human arm.



i) Describe what will happen to the arm when X contracts. **(2 marks)**

ii) What is the function of muscle Y? **(2 marks)**

SECTION B: Answer any THREE questions only

(30 marks)

15. a) Name any one disease caused by bacteria. **(1 mark)**

b) How can you prevent the disease you have named from infecting other people? **(9 marks)**

16. Give five differences between vegetative and sexual reproduction.

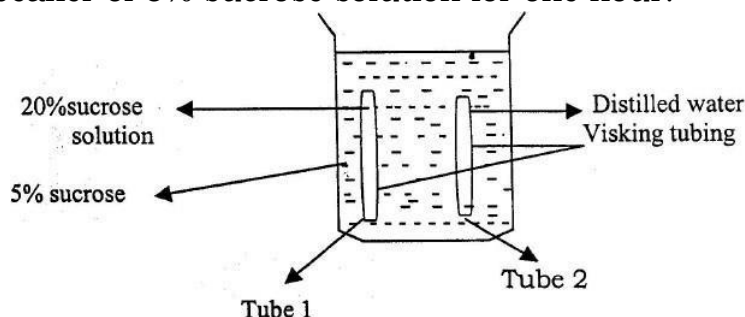
(10 marks)

17. a) What are digestion, absorption, assimilation and egestion? **(4 marks)**

b) Where does each of these functions take place in the body? **(4 marks)**

c) Why must food be digested before the body can use it? **(2 marks)**

18. A student set up this experiment to investigate osmosis. The student filled two pieces of dialysis (Visking tubing) with different liquids and left them both in a beaker of 5% sucrose solution for one hour.



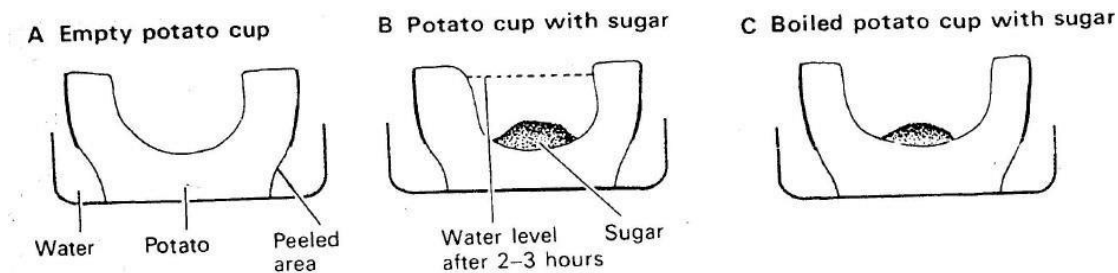
a) Describe and explain the likely result after one hour. **(5 marks)**

b) Describe two examples where osmosis is used in living things. **(5 marks)**

19. a) Photosynthesis is a process that takes place in green leaves.

- i) What type of energy is needed for this process? **(1 mark)**
- ii) What substance(s) in the plant absorbs this energy? **(1 mark)** iii) In which part of the plant cell does photosynthesis take place? **(1 mark)**
- iv) Write the chemical equation for photosynthesis. **(3 marks)**
- b) Describe two ways you would use to speed up photosynthesis. **(4 marks)**
- SECTION C: This section is compulsory. (15 marks)**

20. a) The students performed the experiment illustration below.



- i) Explain in details why water gathers in the hollowed portion of potato B. **(5 marks)** ii) Explain why water does not gather in the hollowed portion of potato A and C. **(5 marks)** iii) Why is potato A necessary in the experiment? **(5 marks)**

**MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL
EXAMINATION 2001/2002**

Section A: Answer all questions

1. *Materials to be supplied to cells for survival include: Water, Amino acids, Glucose (carbohydrates), Enzymes, Vitamins, Mineral salts, Lipids.*
2. *a) Characteristics possessed by plants and animals: Both have mitochondria for respiration, Nucleic acids (DNA, RNA), both have nuclei, ribosomes... b) Characteristics possessed by plants only: Presence of plastids, Presence of cellulose cell wall, Cells with regular shapes...*
3. *A motor car can move, respire (gives out CO₂ and takes in O₂) but it cannot reproduce and grow. The car cannot respond to the external stimuli (no irritability). Therefore it cannot qualify as a living organism.*
4. *Roots and leaves obtain oxygen by the process of diffusion through roots and by stomata of leaves.*
5. *a) Respiration takes place in the mitochondria.
b) The importance of respiration is to give energy
c) The products of respiration are water and carbon dioxide.*

6. a)

Life process	Meaning
Reproduction	Producing fertile offspring
Growth	Getting larger or more developed
Movement	Changing the position of a part or all of the body
Sensitivity	Responding to the environment

b) *System → Organ → Tissue → Cell → Chromosome → Gene*

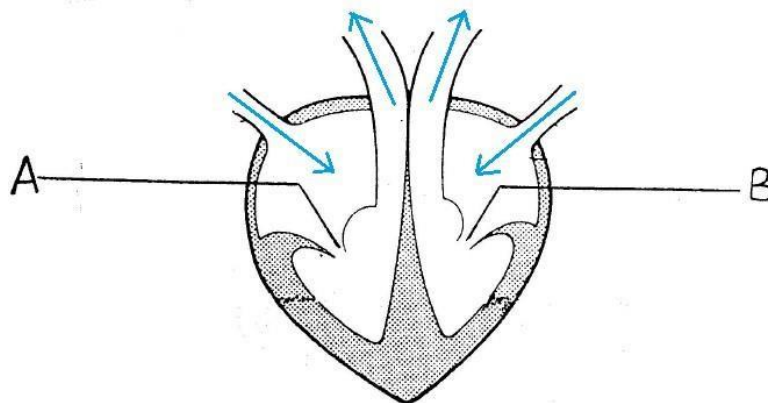
7. *Adaptation of a dicotyledonous leaf to its function: Development of many veins, Extension of leaves.*

8. The requirements of photosynthesis are: Water, Carbon dioxide, Light energy, Chlorophyll.

How the requirements are met in a land plant: Water from soil enters the roots by osmosis; Carbon dioxide: from the atmosphere enters the leaf by the stomata from the atmosphere; Energy from sunlight is trapped by chlorophyll molecules; Chlorophylls are pigments found in the chloroplast of leaves.

9. Recycling of matter, nitrogen fixation, digestion of cellulose in cows, production of vitamins in the large intestine of humans...

10.a)



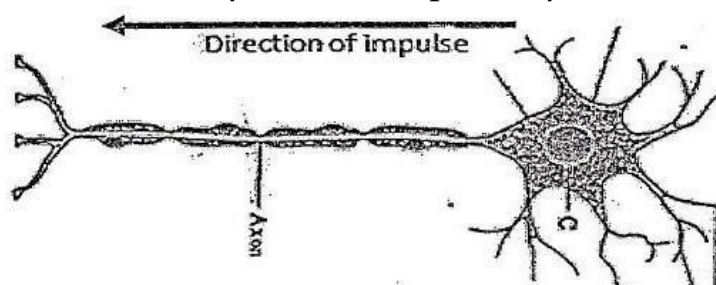
b) The function of Atrio-ventricular valves (A and B) is to prevent back flow of blood in the atria when they contract.

c) Ventricles have thicker muscular walls than atria because ventricles must contract with a strong force (pressure) in order to push blood towards different parts of the body at a long distance whereas atria pump blood from them to the ventricles which is a very short distance.

11. Parts of the nerve cell (motor neuron) A: Cell membrane; B: Cytoplasm; C: Nucleus.

b) The function of part X is to receive the nervous impulse from other neurons.

c) The direction of a nerve impulse: from cell body to axon.



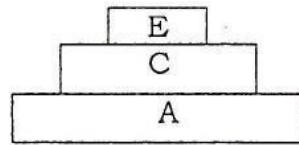
12.a)) Given a simple food web above:

i) Herbivore is B or C.

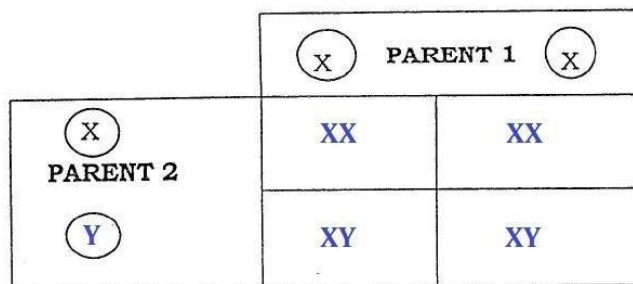
ii) Omnivore is none iii) A producer is A.

b) i) A gets energy from sunlight.

ii) The pyramid of energy for the food web.



13.a)



b) Parent 1 is the mother.

c) The chance of getting a baby boy is 50 %.

14.a) i) A: Sternum B: ribs ii) The function of C is to protect the brain.

b) Animals with exoskeleton include: bees, crabs, houseflies and other arthropods.

c) i) When muscles X (biceps) contracts, there is flexion of the arm and when muscle Y contracts, there is extension of the arm.

Section B: Answer only three questions

15.a) Diseases caused by bacteria include: Tuberculosis (TB), cholera, gonorrhoea, typhoid, syphilis...

b) Prevention of bacterial diseases:

Personal hygiene (body hygiene), good sanitation, wash hands before and after the meal, Drink boiled water, Avoid contaminating rivers and other water bodies).

Avoid coughing around people

Take medicines to avoid infection

Taking antibiotics to kill the bacteria

Isolate infected people

Avoid sex for STDs such as syphilis and gonorrhoea...

16.

<i>Vegetative reproduction (Asexual reproduction)</i>	<i>Sexual reproduction</i>
<i>One parent only</i>	<i>Usually two parents</i>
<i>No gametes are produced</i>	<i>Gametes are produced.</i>
<i>Depends on mitosis</i>	<i>Depends on meiosis</i>
<i>Offspring identical to parent</i>	<i>Offspring are not identical to parents. They show genetic variation</i>
<i>Often results in rapid production of large numbers of offspring</i>	<i>Less rapid increase in numbers</i>

17. a) *Digestion is the physical and chemical process where food substances (macromolecules) are broken down into simpler units (monomers) which are small enough so that can be absorbed into the bloodstream.*

Absorption is the diffusion of nutrients such as glucose and amino acids into the bloodstream.

Assimilation is the use of nutrients by the body cells in different metabolic reactions.

Egestion is the elimination of non-digested food substances to the outside of the body through the anus.

b) *Digestion takes place in different organs of the alimentary canal except the oesophagus, large intestine and the anus.*

Absorption takes place in small intestines.

Assimilation takes place in the body cells.

Egestion takes place in the anus.

c) *Food must be digested before it can be used in order to breakdown large molecules into small molecules that can be absorbed into the blood stream.*

18. a) *Change in tube 1: the volume of 20% sucrose solution will increase.*

In tube 2: the volume of distilled water will decrease.

Explanations:

20% sucrose solution contains more molecules of sucrose than in 5% sucrose solution, but this 5% sucrose solution has more water (or has a high water potential) than the 20% sucrose solution (has a low water potential). This is why water molecules will move from tube 1 by osmosis thus increasing the volume of tube 1.

Tube 2 will lose some molecules of its water moving towards the 5% sucrose solution. Tube 2 has more molecules of water (or has a high water potential) than the 5% sucrose solution (has a low water potential) in the beaker. Always water molecules move from a medium of high water potential (hypotonic solution) to a medium with low water potential (hypertonic solution) through a selectively permeable membrane by osmosis. b) In living things, osmosis is used in:

Absorption of water from the small intestines to the blood stream.

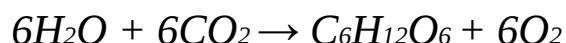
Absorption of water by roots.

Reabsorption of water in the kidneys.

Transpiration in the leaves through stomata

Entrance of water in vacuoles of plant cells

- 19.a) i) The type of energy needed by photosynthesis is sun light energy. ii) Chlorophyll absorbs this energy
iii) Photosynthesis takes place in the chloroplast of the plant cell.
iv) The chemical equation for photosynthesis is:*



b) The rate of photosynthesis can be increased by: increasing the intensity of light; provision of more water; increasing the concentration of carbon dioxide.

SECTION C: THIS QUESTION IS COMPULSORY

- 20.a) i) Reasons why water gathers in the hollowed portion of potato B: The sugar present in the hollowed portion of potato form a more concentrated medium. It exerts an osmotic pressure on the potato cells and attract water from the potato within a hollowed*

portion (cavity). Water will move from the potato (hypotonic solution) to the sugar medium (hypertonic solution) increasing the water level in the hollow portion of the potato. ii) Water does not gather in the hollowed portion of potato A and C because:

The cells of potato A have equal concentrations.

Water does not enter in C because it is boiled; the heat kills the cells of C: therefore no osmosis because osmosis takes place only in living cells.

iii) Potato A is a control experiment.

RWANDA NATIONAL EXAMINATIONS COUNCIL

BIOLOGY III

017

11th Nov. 2003 08.30am –11.30am



P.O.BOX, 3817 KIGALI-TEL/FAX : 86871

ORDINARY LEVEL NATIONAL EXAMINATION 2002/2003

SUBJECT: BIOLOGY III

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A**, **B** and **C**

Answer **ALL** questions in section A. **(55 marks)**

Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

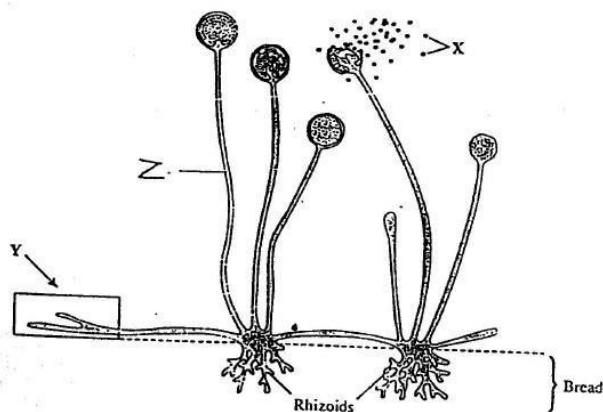
SECTION A: ANSWER ALL QUESTIONS

(55 MARKS)

1. (a) Write AIDS in full. **(1 mark)**

(b) What is the difference between AIDS and HIV? **(2 marks)**

2. The diagram shows part of the structure of a fungus growing on some bread.



(i) Name structures labelled X

Z **(2 marks)**

(ii) When the fungus is feeding, the tips of hyphae labelled Y release enzymes.
Explain why? **(2 marks)**

3. Give differences between a butterfly and a moth. **(3 marks)**

4. What are main stages of incomplete metamorphosis? **(3 marks)**

5. Give at least three functions of blood. **(3 marks)**

6. (a) Sportsmen are normally given glucose and not sucrose after exercise.
Explain why. **(2 marks)**

(b) What are the products of glucose oxidation? **(1.5 marks)**

7. (a) Describe three ways in which plant cells are different from animal cells. **(1.5 marks)** (b)

Name structures that are common to both animal and plant cells.

(3 marks)

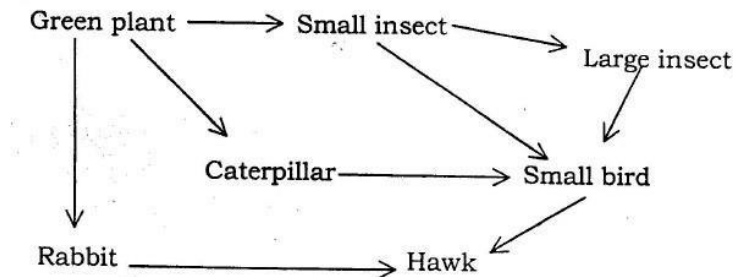
8. Name excretory organs and their respective waste products. **(4 marks)**

9. What are functions of the skin? **(3 marks)**

10. Which hormones are produced by the pancreas gland? What are the functions of these hormones? **(4 marks)**

11. (a) What is the initial organism in any food chain? Explain your answer. **(2 marks)**

(b) Study the food web below:



(i) Which organisms are (i) Primary Consumer?

(ii) Secondary consumer? (2 marks)

(ii) What would happen if small insects died? **(2 marks)**

12. Plants need water which often has mineral salts dissolved in it.

(a) What do plants make from the following minerals? (i) Nitrates

(ii) Magnesium (2 marks)

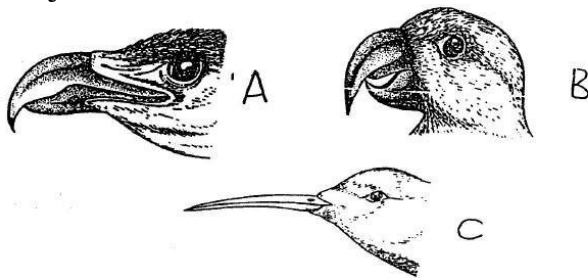
(b) Give two reasons why water is important to plants. **(2 marks)**

(c) (i) in which vessels does water travel up through the plant? **(1 mark)**

(ii) In which vessel does sugar travel through the plant? **(1 mark)**

13. What are the main classes of phylum arthropoda. **(3 marks)**

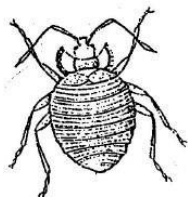
14. Study the beaks below.



Suggest the feeding habits of these birds.

Explain your answer. **(3 marks)**

15. The organism below belongs to the class insect.



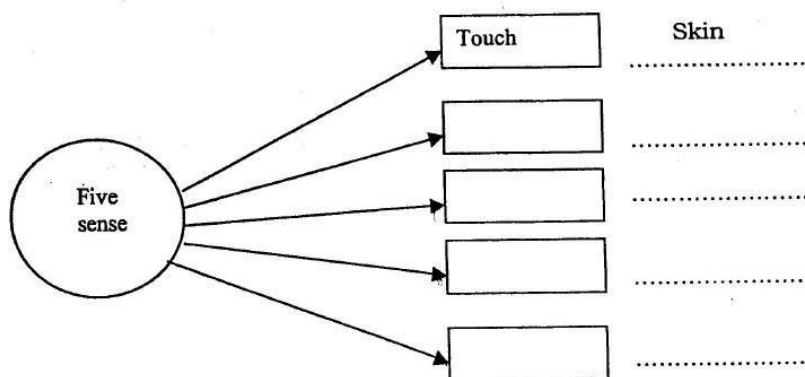
Suggest reasons why.

(3 marks)

SECTION B: Answer any THREE questions only

(30 marks)

16. (a) Humans have a number of senses, for example touch. Senses are detected by receptors for example the skin detects touch. In the box write the names of other senses. By each box write the name of the receptor.



- (8 marks)** (b) When your hand is touched, the information is passed to your brain. Describe how the information gets from your skin to your brain. **(2 marks)**

17. (a) Name the organs in which mitosis occurs in mammals. **(2 marks)** (b) What is the importance of mitosis in living organisms? **(2 marks)** (c) In a breeding experiment with garden peas, a sample of plants with white flowers and breed true was crossed with a sample of plants which produce red flowers and breed true. When the seeds produced were grown all the resulting F_1 generation produced red flowers.
- (i) Why were no white flowers produced by plants belonging to the F_1 generation? **(2 marks)**
- (ii) Using genetic symbols, explain what would result from interbreeding the F_1 generation? **(4 marks)**

18. (a) What is an enzyme? **(2 marks)**

- (b) Describe the characteristics of enzymes? **(6 marks)**

(c) What part is played by enzymes in the germination of maize? **(2 marks)**

19. (a) Give examples of microorganisms. **(2 marks)**

(b) Describe the importance of microorganisms to man. **(8 marks)**

20. Malaria is a killer disease in Africa especially South of the Sahara.

(i) What causes Malaria? **(2 marks)**

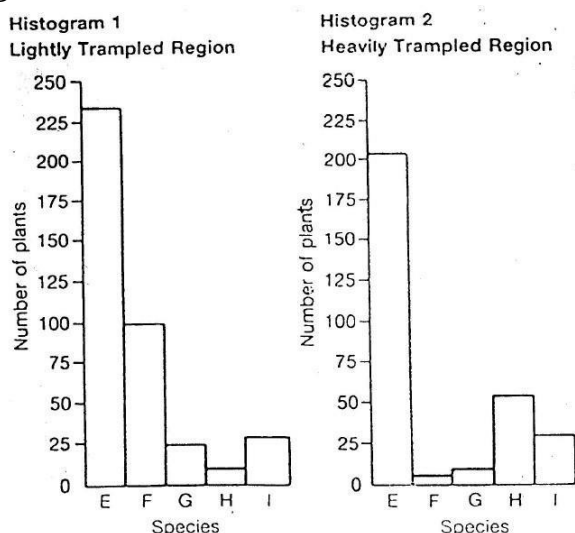
(ii) Suggest possible methods you would use to eradicate Malaria in your village. **(5 marks)**

(iii) What steps has the government of Rwanda taken to reduce the infection of Malaria? **(3 marks)**

SECTION C: This section is compulsory.

(15 marks)

21. (a) A group of students studied two areas of grassland. One lightly trampled and the other heavily trampled. The histograms below show the numbers of plants of five different species found in random samples taken within each region.



(i) How many of species E were found in each region? **(2 marks)** (ii) What is the effect of increased trampling on species G and H?

(1 mark)

(iii) Which species are most affected by trampling? **(1 mark)**

(iv) Which species are least affected by trampling? **(1 mark)** (b) The following organisms were found on abandoned farm.

- Green plants
- Hawks
- Lizards
- Grasshoppers and
- Snakes

(i) Construct a pyramid of numbers to show their relationship.

(3 marks) (ii)

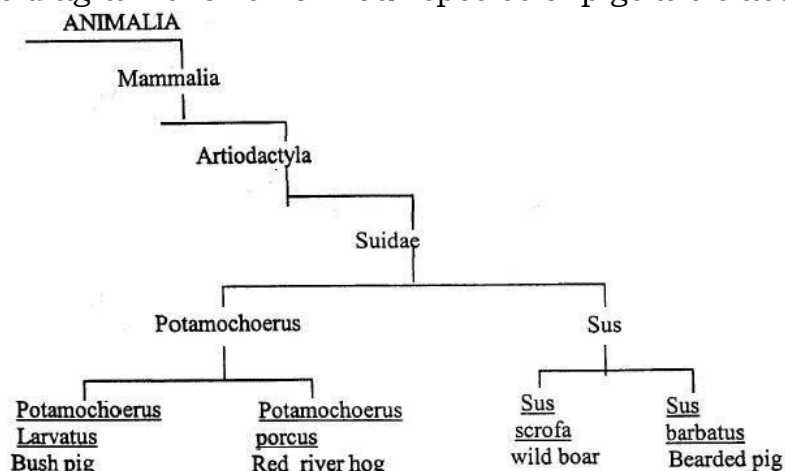
Which organism(s) are:
Tertiary consumers

Top carnivores

Herbivores

(3 marks)

(c) The diagram shows how four species of pigs are classified.



(i) To which class do these pigs belong? (1 mark)

(ii) To which family does the red river hog belong? (1 mark)

(iii) To which genus does the boarded pig belong? (1 mark)

(iv) Give the species name of Bush pig. (1 mark)

MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2002/2003

Section A: Answer all questions

1. a) AIDS stands for Acquired Immuno-Deficiency Syndrome
b) HIV is the causing agent of AIDS, meaning the virus which causes AIDS. AIDS is a set of symptoms due to the infection by HIV.

2. (i) X: Spore; Z: sporangium
(ii) During feeding of a fungus, the hyphae releases enzymes to digest or to decompose soluble organic matter into materials that can be absorbed by the fungus.

3.

Butterfly	Moth
Pointed antennae	Crusted antennae
Fly at night	Fly during the day
Horizontal wings at rest	Vertical wings at rest
Large scales	Small and fine scales

4. Egg; Larva; Pupa and Adult.

5. Transport of oxygen

Transport of nutrients (glucose, amino acids...)

Transport of urea

Transport of carbon dioxide

Protection against diseases.

Temperature regulation

6. (a) After exercise, sportsmen are given glucose and not sucrose because glucose doesn't need to be digested. It can directly be absorbed whereas sucrose needs to be first digested into glucose and fructose before absorption. This would take much time compared to glucose.

(b) Energy, carbon dioxide and water.

7.

Animal cell	Plant cell
No cell wall	Have cell walls
Have irregular shape	Have regular shape
No chloroplasts	Have chloroplasts
Small vacuole when present	Large vacuole

b) Both have nucleus, mitochondria, cytoplasm, ribosomes

8.

Excretory organs	Excretory products
Lungs	Carbon dioxide
Kidneys	Urine
Skin	Sweat
Liver	Bile

9. Protection; excretion; temperature regulation; reception of external stimuli; production of vitamin D...

10. Hormones produced by the pancreas are insulin and glucagon.

Insulin decreases blood glucose level. Glucagon increases blood glucose level.

11. (a) Plants because they are producers (they make their own food). (b)

(i) Primary consumers are small insects, caterpillar and rabbit.

- (ii) The secondary consumers are large insect, small bird and hawk.
- (c) Increase of green plants.
 Decrease of small bird.
 Death of large insects.

12.(a) (i) synthesis of amino acids and proteins.

(ii) Production of chlorophyll

(b) It is a reactant in photosynthesis.

It is used in the transport of substances such as minerals and food. It is used to make plant cells turgid.

It is a solvent of different substances.

(c)(i) Xylem

(ii) Phloem

13. Crustacea, insecta, arachnida, chilopoda and diplopoda.

14.

Beak	Feeding habitat	Reason
A	Carnivore	Uses its beak to kill its prey and removes meat from bones
B	Granivore	Uses its beak to break hard seeds.
C	Nectararian	Uses its beak being long to suck nectar from flowers

15. It has a body divided into three parts; it has antennae; it has a segmented body.

Section B: Answer only three questions

16. (a)

Sense	Receptor
Touch	Skin
Taste	Tongue
Hearing	Ear
Smell	Nose
Sight	Eye

(b) The stimulus stimulates the skin receptors.

The receptors transform the stimulus into a nerve impulse which is carried to the brain by sensory neurons.

The nerve impulse is analysed by interneurons and the commands are taken back to the effector by motor neurons.

17. (a) Mammals: skin and bones

Flowering plants: roots, terminal nuds

(b) Growth, replacing dead and damaged cells, asexual reproduction...

(c) (i) The allele for white flowers is recessive to the allele for red flowers which is dominant.

(ii) R: red flower; r: white

flower The genotype of red flower: RR

The genotype of white flower: rr

Parent: RR X rr

Gametes: R and r

F₁: Rr

F₂: Interbreeding of F₁ generation (F₁

X F₁) Rr X Rr

Gametes: R, r and R, r

Gametes	R	r
R	RR	Rr
r	Rr	rr

Offspring genotypes: 25 % RR; 50 % Rr; 25% rr

Offspring phenotypes: 75 % Red; 25% white.

18. (a) Enzymes are proteins that catalyze (i.e., increase the rates of) biochemical reactions. In enzymatic reactions, the molecules at the beginning of the process, called **substrates**, are converted into different molecules, called **products**.

(b) Characteristics of enzymes:

- **Enzymes are not destroyed by the reaction** they catalyze and so can be used again.
- **An enzyme can work in either direction.** Metabolic reactions are reversible and the direction in which they proceed depends on the relative amounts of substrate and products present. The reaction will proceed from left to right until equilibrium between substrate and products is reached

- **Enzymes are inactivated by excessive heat.** This property of enzymes relates to the fact that they are proteins. The proteins (and therefore enzymes) are denatured at high temperatures. Few cells can tolerate temperatures higher than approximately 45°C.
 - **Enzymes are sensitive to PH.** Every enzyme has its own range of PH in which it functions most efficiently. Most intracellular enzymes function best at or around neutral. Excessive acidity or alkalinity renders them inactive.
 - **Enzymes are specific** in the reaction they catalyze, much more than inorganic catalysts. Normally, a given enzyme will catalyze only one reaction or type of reaction. However, the degree of specificity varies from one enzyme to another.
 - **Enzymes lower the activation energy of reactions they catalyze.** The activation energy is the energy necessary for a reaction to get started.
 - **Enzymes possess active sites where the reaction takes place.** These sites have specific shapes.
 - **All enzymes are globular proteins.**
- (c) Breakdown of stored organic substances such as starch, proteins and lipids into monomers such as glucose, amino acids and fatty acids to be used by the embryo during germination.
19. (a) Bacteria (*Vibrio cholerae*, *Mycobacterium tuberculosis*, *Bacillus subtilis*), viruses (HIV, ebola), microscopic fungi, algae
- (b) Fermentation, production of cheese and yoghurt, recycling of matter, nitrogen fixation, production of vitamins, used in genetic engineering to produce insulin.
20. (a) Malaria is caused by a protozoan called *Plasmodium*.
- (b)
- Clear the mosquito habitat: Bush, stagnant water etc...
 - Spray mosquitoes with insecticide
 - Use of antimalarial drugs
 - Use of insect repellent to prevent mosquitoes etc.
 - Sleeping under mosquito nets
- (c) Sensitize people about the bad effects of malaria on Radio and TV. Distribution of treated mosquito nets.

Importation of medicines against malaria.

Availability of health insurance so that every person can have access to health facilities.

SECTION C: THIS QUESTION IS COMPULSORY

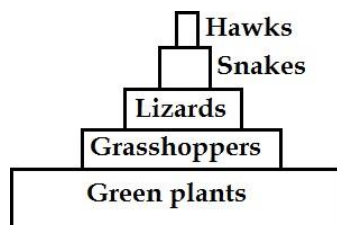
21. (a) (i) *Species of E in lightly trampled region: 233 Species of E in heavily trampled region: 203*

(ii) Trampling decreases the number of species G.

Trampling increases the number of species H. (iii) F.

(iv) I

(b)(i)



(ii) Tertiary consumers:

Snakes Top carnivores:

Hawks

Herbivores: Grasshoppers

(c) (i) These pigs belong to class Mammalia

(ii) Red river hog belongs to family Suidae (iii) The bearded pig belongs to genus Sus.

(iv) The species name of Bush pig is Larvatus.

BIOLOGY III

017

08th Oct. 2004 08.30am –11.30am

REPUBLIC OF RWANDA



NATIONAL EXAMINATIONS COUNCIL
P.O.BOX 3817 KIGALI

ORDINARY LEVEL NATIONAL EXAMINATION 2003/2004

SUBJECT: BIOLOGY III

LEVEL: TRONC COMMUN

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A, B** and **C**

Answer **ALL** questions in section A. **(55 marks)**

Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

SECTION A: ANSWER ALL QUESTIONS **(55 MARKS)**

1. Movement is a life process. Name four other life processes that all plants and animals do. **(4 marks)**
2. (a) Name at least three diseases spread by flies. **(3 marks)**
(b) How can you prevent the spread of such diseases? **(3 marks)**
3. Match the following organisms against their respective groups.

Organisms

Trichomonas
Amoeba
Paramecium

Groups

Sporozoa
Ciliata
Rhizopoda

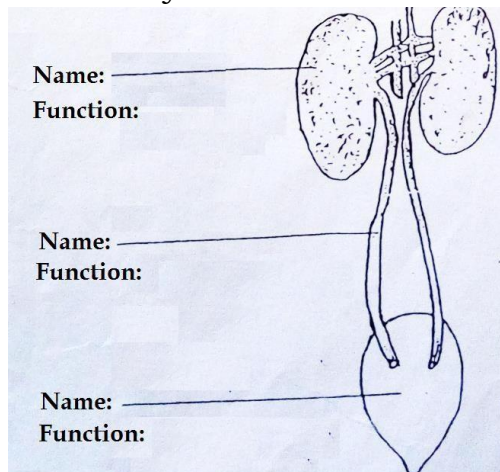
4. Identify the organism shown below:



(a) Name (1 mark)

(b) What is its feeding habits (trophic level) (2 marks)

5. The diagram below shows part of the system that controls the amount of water in the body.



6. What features enable a leaf to be adapted for photosynthesis? (6 marks)

7. The following results were obtained by a student who crossed the F_1 generation of pure breeding parents for normal and wrinkled seeds.

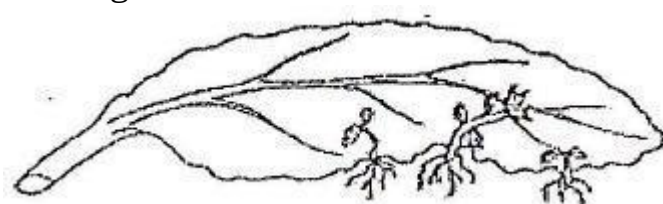
Dominant trait	Recessive trait	Numbers of F_2 offspring.
Round seeds	Wrinkled seeds	7524

(a) Define the following terms.

- i) Dominant (1 mark) ii) Recessive (1 mark) (b) Calculate the number of Round and Wrinkled seeds. Show your working. (2 marks)

8. Pollination may occur without fertilization taking place but fertilization will not occur without pollination. Explain. (3 marks)

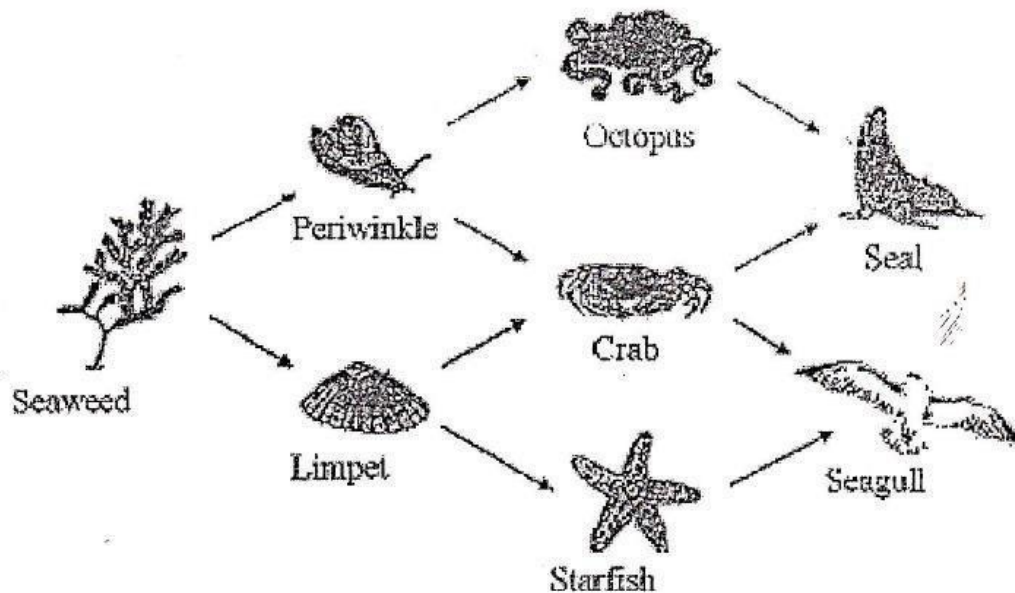
9. The diagram below shows a leaf developing buds and adventitious roots along its margin.



- (i) What type of reproduction is shown by this leaf? **(2 marks)**
(ii) What advantage does this leaf have over other leaves? **(2 marks)**

10. Which characteristics distinguish insects from other animals? **(3 marks)**

11. The diagram below shows part of a food web.

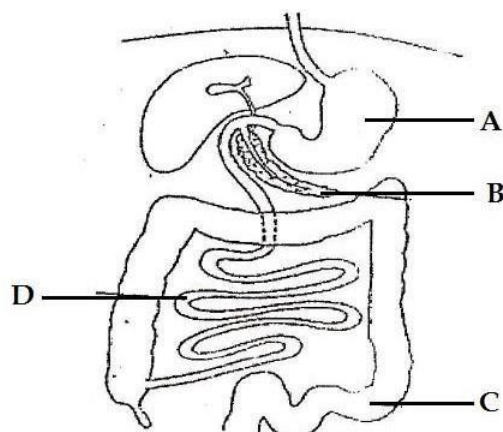


Use the organism in this web to fill in the table.

(5 marks)

FEEDING HABIT	ONE ORGANISM
Herbivore	
Producer	
Secondary consumer	
Top carnivore	
Primary consumer	

12. The diagram below shows the structure of the human gut.



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

(3 marks)

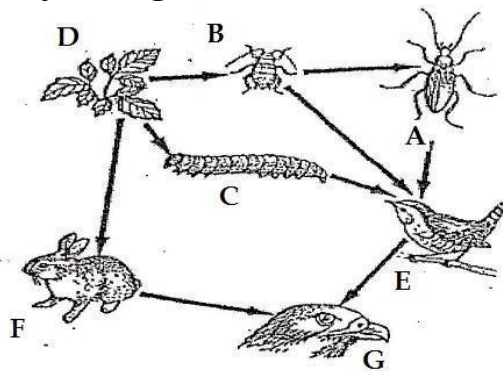
- A:
B:
C:

- (b) Name two processes carried out in structure D. **(2 marks)**
 1:
 2:
 (c) Humans require in their diet. State one function of fibre in their diet. **(1 mark)**
 (d) Give two main functions of structure B. **(2 marks)** 1:
 2:

SECTION B: Answer any THREE questions only (30 marks)

13. a) Name FOUR components found in human blood. For each named component, give one function that it carries out. **(8 marks)** b) Explain why unicellular organisms such as Amoeba do not need a transport system. **(2 marks)**

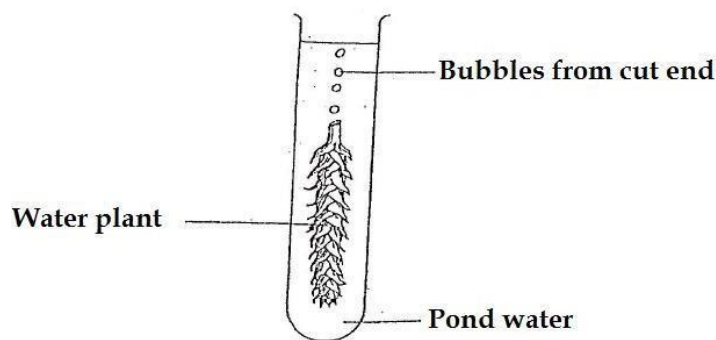
14. Study the figure below and answer the questions that follow:



- (a) Suggest the feeding level (trophic level) of organisms A, B, D, E and F. **(5 marks)**
 (b) Explain the effect on each organism of removing organism G from the food web. **(5 marks)**
 15. (a) Name the component of gastric juice produced in the stomach. **(10 marks)**
 (b) Give their main functions.
 16. A plant with Red flowers was crossed with one with white flowers. All the F₁ offspring had red flowers.
 (a) Explain why there were no white flowers in F₁ offspring.
 (b) Using suitable genetic symbols, show the genotype and phenotypes of crossing F₁ offspring among themselves. **(10 marks)**
 17. Describe the main functions of the liver. **(10 marks)**

SECTION C: This section is compulsory. (15 marks)

18. Students in a certain school performed the experiment below.



A stream of bubbles is given off from the cut end of the water plant when it is put outside in the open. The rate at which bubbles were given off was counted at noon on different days. The results are shown in table below.

Weather / light	Number of bubbles per minute
Day 1 very cloudy	4
Day 2 light cloudy	10
Day 3 sunny	13
Day 4 sunny	15
Day 5 cloudy	7

- What gas is given off? **(2 marks)**
- What process is being investigated? **(2 marks)**
- From observation, what can you say about the effect of weather conditions on the process? **(3 marks)**
- Name the factors that may be affecting the rate of bubbling. **(3 marks)**
- Describe how you would investigate the effect of light intensity on the rate of bubbling. (Assume that a meter for measuring light intensity is available). **(5 marks)**

MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2003/2004

Section A: Answer all questions

- Reproduction, irritability, growth, nutrition, respiration and excretion.*
- Some of the diseases spread by flies are: typhoid, cholera, diarrhoea, amoebic dysentery...*
 - Ways to prevent such diseases are: cover the food, cover the toilets.*
- Organisms and their respective groups:*

Organisms	Groups
<i>Trichomonas</i>	<i>Flagellata</i>
<i>Amoeba</i>	<i>Rhizopoda</i>
<i>Paramecium</i>	<i>Ciliata</i>

Plasmodium	Sporozoa
------------	----------

4. (i) Millipede

(ii) Is a herbivore (primary consumer). This means that it feeds on plant material.

5. A: Left kidney

Function: it filters blood to form urine; removal of metabolic waste products such as urea; elimination if excess water and salts; regulation of blood PH.

B: Left ureter

Function: it conducts urine from the kidney to the bladder.

C: Urinary bladder

Function: it stores urine temporarily before it is removed from the body.

6. Adaptations of the leaf for photosynthesis

- A large surface area that collects as much sunlight as possible.
- A thin lamina (leaf blade), as most light is absorbed in the first few millimetres of the leaf and the diffusion distance is kept short.
- A transparent cuticle and epidermis that let light through to the photosynthetic palisade cells beneath.
- Numerous stomata for gaseous exchange that open and close in response to changes in light intensity.
- Many air spaces, especially in the spongy mesophyll, to allow diffusion of carbon dioxide and water.
- A network of vascular tissue made up of xylem that brings water to the leaf cells and phloem that carries away the sugars produced in photosynthesis.

7. (a) (i) Dominant: an allele that is expressed in the heterozygous state.

(ii) Recessive: an allele that is expressed in the homozygous state only. Or an allele that is not expressed in the heterozygous state.

(b) Phenotypic ratio in The F₂ generation: 3 Round : 1 wrinkled

$$\text{Round seeds} = \frac{7524 \times 3}{4} = 5643$$

$$\text{Wrinkled seeds} = \frac{7524 \times 1}{4} = 1881$$

8. Pollination may occur without fertilization taking place because the pollen grains can be transferred from anthers to the stigma and could not germinate to the stigma along the style in order to reach the micropyle of the ovule. Fertilization cannot take place without pollination because the pollen grains must be deposited on the stigma from the pollen grains and grow along the style until when fertilization occurs.
9. (i) The type of reproduction shown is asexual reproduction or vegetative reproduction.
 (ii) Advantages of asexual reproduction:
 Only one parent is required.
 Rapid reproduction
 Offspring are identical to their parents, so they share good characters
10. Common characteristics of insects: body divided into three parts; have three pairs of legs; have one pair of antennae.

11.

Trophic level	Organism
Herbivore	Periwinkle
Producer	Seaweed
Secondary consumer	Starfish, crab and octopus
Top carnivore	Seal, seagull
Primary consumer	Limpet, periwinkle

- 12.(a) A: stomach; B: pancreas; C: Large intestine (colon).
 (b) Secretion and absorption
 (c) The function of fiber in the human diet is to facilitate the passage of food in the digestive system.
 (d) Secretion of digestive enzymes and secretion of hormones.

Section B: Answer only three questions

- 13.(a) The components of blood are the white blood cells (leucocytes), red blood cells (erythrocytes), platelets (thrombocytes) and plasma.

Plasma: transports nutrients, urea, hormones, blood cells... **Red blood cells:** transports oxygen and carbon dioxide.

White blood cells: body defence, production of antibodies.

Platelets: blood clotting.

- (b) Unicellular organisms such as amoeba do not need a transport system because they have a large surface area to volume ratio. Diffusion alone is enough to carry nutrients and to remove metabolic waste products from the cell.

14.(a) Organisms and their trophic (feeding) level

Organisms	Trophic level
A	Secondary consumer
B	Primary consumer
D	Producer (autotroph)
E	Tertiary consumer since it consumes A. Secondary consumer since it consumes C.
F	Primary consumer (herbivore)

- (b) Removing organism G from this food web results into: Increase of E.

Decrease of A, B and C.

Increase of D and F.

15.(a) The main components of gastric juice are: hydrochloric acid, mucus, rennin and pepsin.

- (b) **Functions of HCl:** kills bacteria present in the food; inactivates salivary

amylase (ptyalin); activates pepsin (converts inactive pepsinogen into active pepsin); provides a suitable PH for the functioning of pepsin and rennin.

Function of pepsin: converts proteins into small peptides.

Functions of mucus: to prevent the digestion of the walls of stomach by pepsin; to stop the acidic action on the walls of the stomach.

Function of rennin: coagulates milk (converts a soluble protein called caseinogen present in the milk into an insoluble protein called casein).

16.(a) The allele for red flower is **dominant** over the allele for white flowers because the F_1 offspring have red flowers.

The allele for white colour is recessive because it is not expressed in the heterozygous individual.

(b) R : red flower; r : white flower

The genotype of red flower: RR

The genotype of white flower: rr

Parents: $RR \times rr$

Gametes: R and r

F_1 : Rr

F_2 : Interbreeding of F_1 generation ($F_1 \times F_1$)

$Rr \times Rr$

Gametes: R, r and R, r

Gametes	R	r
R	RR	Rr
r	Rr	rr

Offspring genotypes: 25 % RR ; 50 % Rr ; 25% rr
Offspring phenotypes: 75 % Red; 25% white.

17. The main functions of the liver

- Production of bile
- Detoxification
- Production of heat
- Production of red blood cells in the foetus
- Regulation of nutrients
- Storage of blood
- Storage of minerals
- Storage of glucose in the form of glycogen
- Destruction of old red blood cells
- Elimination of sex hormones after they have performed their functions.

- *Storage of vitamins...*

SECTION C: THIS QUESTION IS COMPULSORY

18.(i) Oxygen

(ii) Photosynthesis

(iii) Weather conditions have minimal effect on this process, this is because the water weed is in water which has a stable temperature. Also, changes such as wind would not affect the rate of photosynthesis.

(iv) Sunlight intensity, Number of leaves, Carbon dioxide concentration.

(v) You place a bulb at some long distance away from the experimental setup. You then observe the rate at which the bubbles are formed. You then move the light source (bulb) nearer and still observe the rate with which bubbles are formed. You further reduce the distance between the bulb and the setup and compare the rate of bubble formation. Finally when the distance is too small in between, you observe the rate of bubbles formed.

A table is then drawn showing the rate of bubbles formed and the distance in between.

A table showing the rate of bubble formation and distance in between

Distance in between	Rate of bubbles formed
100 cm	No bubbles
50 cm	Few bubbles
25 cm	More bubbles
5 cm	Very many bubbles

Conclusion:

The higher the light intensity, the faster the rate of photosynthesis and hence the more bubbles are produced. The reverse is also true.

REPUBLIC OF RWANDA



NATIONAL EXAMINATIONS COUNCIL
P.O.BOX 3817 KIGALI

BIOLOGY III

002

18th Nov. 2005 08.30am –11.30am

ORDINARY LEVEL NATIONAL EXAMINATION 2005

SUBJECT: BIOLOGY III

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A, B** and **C**

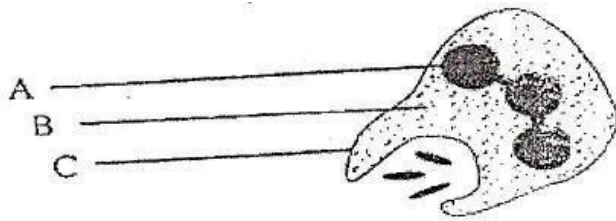
Answer **ALL** questions in section A. **(55 marks)**

Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

SECTION A: ANSWER ALL QUESTIONS (55 MARKS)

1. This is a white blood cell ingesting bacteria.
(a) Name the labelled parts of the white blood cell.



A:

B:

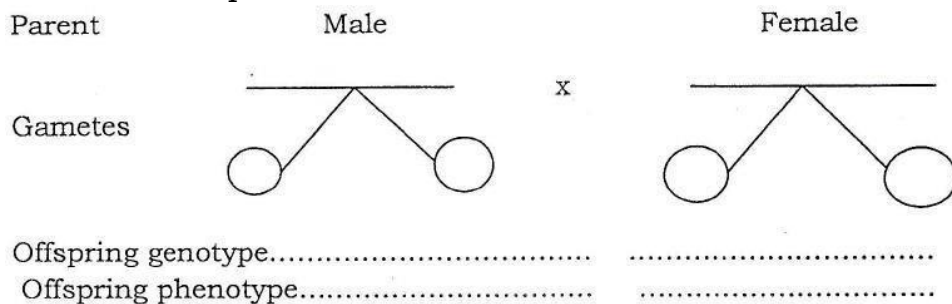
C:

(3 marks)

(b) Explain how a bacterial infection could give someone a sore throat.

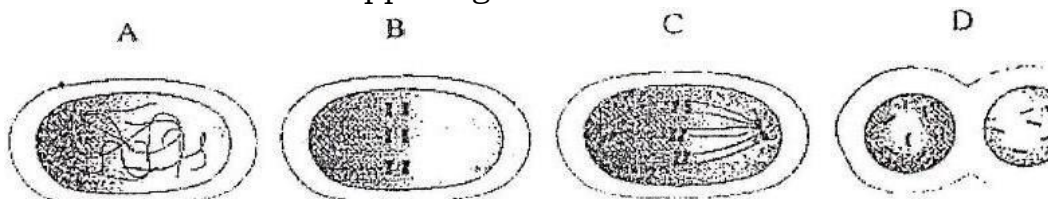
(2 marks)

2. (a) A pregnant woman asks her doctor the chances of her baby being a boy. The doctor says that there are equal chances of the baby being a boy or a girl. Complete the diagram below to explain why the doctor said this. Use X and Y to represent the sex chromosomes.



(3 marks)

(b) Cells divide by mitosis. The stages are shown below for stages B, C and D. Describe what is happening to the chromosomes.



A:

.....

B:

C:

(6 marks)

3. The potato plant reproduces asexually by producing stem tubers.

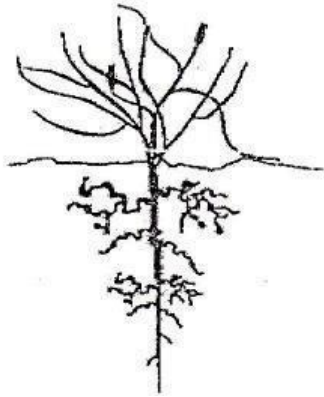
(a) (i) What is asexual production? **(1 mark)**

(ii) Many plants can reproduce asexual.ly. Explain why these plants still need to be able to cross-pollinate. **(1 mark)**

4. The plant in the diagram below gets its water from the soil in a plant pot.

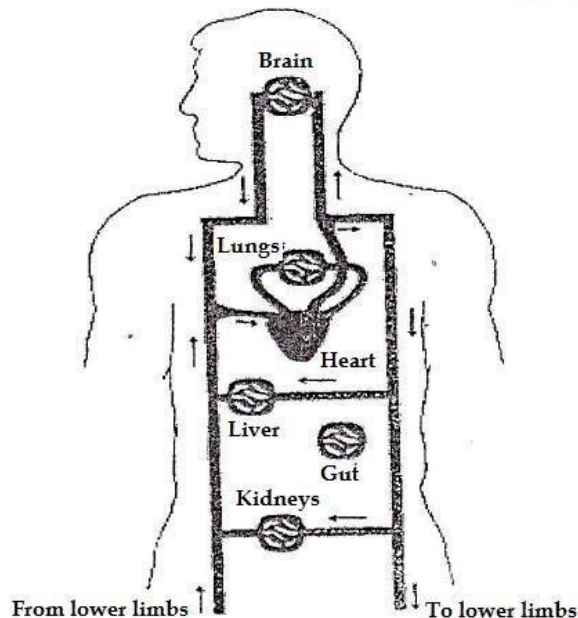


- (a) (i) Which tissue in the plant stem carries water up the plant? **(1 mark)**
 (ii) How does this plant lose water through its leaves? **(1 mark)**
- (b) The plant below is called marram grass. It can grow in very dry sandy soil.



Explain how marram grass is well adapted to survive in dry environments. **(2 marks)** (c)
 Why is it important for flowering plants to be cross-pollinated? **(2 marks)**

5. (a) The diagram below shows the direction of blood flow around the body



- (i) Label on the diagram the pulmonary vein and the Aorta. **(2 marks)**
 (ii) Draw on the diagram the blood supply to and from the gut (include arrows to indicate which direction the blood is flowing). **(3 marks)** (b) Red blood cells contain haemoglobin. As the blood passes through the lungs, the

haemoglobin undergoes a chemical change which makes it more red. Which gas causes the chemical change? **(1 mark)**

6. The diagram shows a sperm cell.



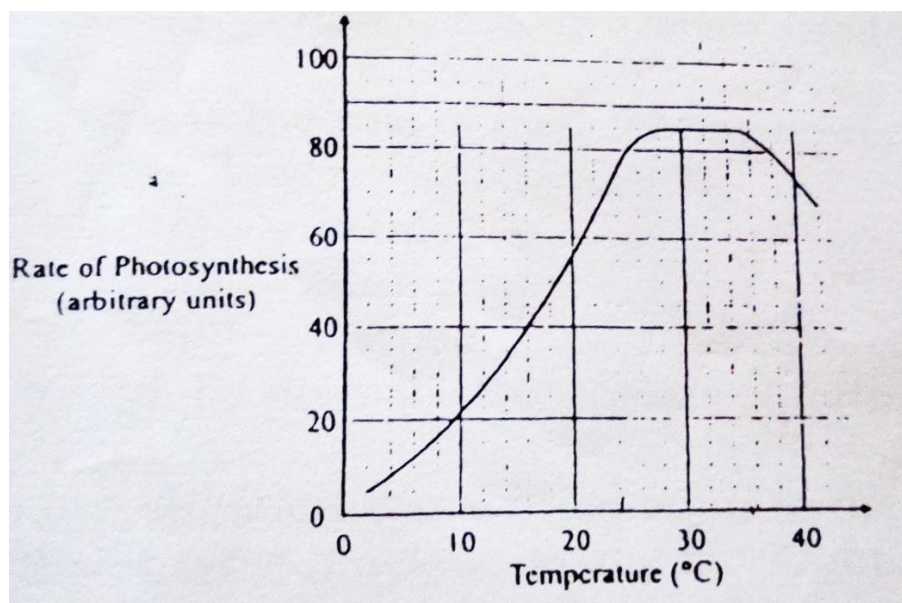
- (a) (i) What is the function of this cell? **(1 mark)**
(ii) How does the part labelled A help the sperm to carry out its function? **(1 mark)**
(b) Part B contains information which is passed from father to his children.
(i) Name the Part labelled B. **(1 mark)**
(ii) What structures present in part B contain this information? **(1 mark)**

7. The diagram shows a skull of a carnivorous mammal.



Identify the features that show that this mammal is adapted for a carnivorous diet. **(2 marks)**

8. (a) The salivary glands in our mouth produce an enzyme called amylase. What does this enzyme do? **(2 marks)**
(b) (i) Our stomachs release hydrochloric acid which helps to kill bacteria. Give other two functions of this acid. **(2 marks)**
(ii) Name at least two enzymes produced by our stomachs. **(2 marks)**
9. (a) How does a person's body react when their glucose level is high? E.g. after a meal? **(2 marks)**
(b) Explain how the body reacts when the glucose level is too low. **(2 marks)**
10. A florist has started a business of growing his own flowers all year round. This graph shows how the rate of photosynthesis within a leaf is affected by temperature.



(a) In order to grow them as quickly as possible, the florist has installed a thermostat in his green house.

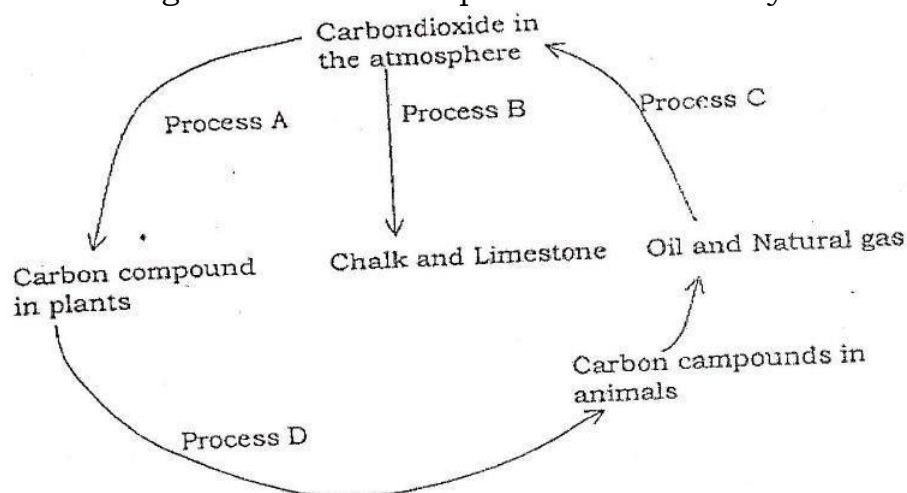
(i) At what temperature should he set the thermostat? **(1 mark)**

(ii) Explain why you have chosen that temperature. **(2 marks)**

(b) Why does the rate of photosynthesis decrease below 35°C? **(1 mark)**

(c) Give two reasons why the rate of photosynthesis remains constant between 28°C and 35°C. **(2 marks)**

11. The diagram below shows part of the carbon cycle.



(a) What are the processes shown as A, B, C and D? **(4 marks)**

A:

B:

C:

D:

(b) Describe two human activities that are disrupting the natural carbon cycle. **(1 mark)**

SECTION B: Answer any THREE questions only (30 marks)

12. Ann is polydactylous; this is a condition which means she has six fingers on each hand and six toes on each foot. Polydactyly is controlled by one pair of genes, and is caused by a dominant allele, P.

- (a) (i) What is a dominant allele? **(1 mark)** (ii) Ann has two dominant P alleles for polydactyly. What is the term for a person who has two identical alleles for a particular gene?

(2 marks)

- (b)** (i) Ann is married to a man with two recessive alleles (pp) for the condition. A fertilized egg produced by the couple divides by mitosis to form two cells. Which allele would the two cells contain? **(2 marks)**

(ii) What is a recessive allele? **(1 mark)**

- (c)** A polydactylous man has one P allele and one p allele. He is married to a woman who has two recessive alleles (pp) for the condition. They plan to have a baby. What are the chances that their child will be polydactylous? **(4 marks)**

13. Cholera is a highly dangerous disease which is spread by bacteria. It is spread by eating or drinking food or water which is contaminated with the bacteria.

- (a) Which part of the body is likely to be infected first when someone drinks water containing the cholera bacteria? **(1 mark)**

- (b) Explain how the cholera bacteria inside the body may cause disease.

(2 marks) (c)

Name other groups of microbes that frequently cause disease.

(1 mark)

- (d)** People crowded together in refugee camps are likely to catch the disease. Explain why. **(3 marks)**

- (e)** Explain how the body defends itself against bacteria. **(3 marks)**

14. (a) What is the role of the following flower parts in the reproduction of the flower?

(i) Petals

(ii) Stamens

(iii) Carpels **(5 marks)**

- (b) Briefly describe the process of fertilization in plants. **(5 marks)**

15. An investigation was carried out into the effects of PH on the action of the enzyme amylase on starch. Eight test tubes were set up at different PH and incubated in water at 30°C for one hour. The amount of reducing sugar (product) was then estimated. The results are shown in the table below.

PH	4.0	5.0	6.0	6.5	7.0	8.0	9.0	10.0
Amount of reducing sugar products	1	12	26	32	33	27	13	5

- (a) Plot a graph to show these results. **(3 marks)**

- (b) Explain the effect of PH on the action of amylase in this investigation.

(3 marks)

- (c)** What is the most suitable PH for the enzyme amylase in this investigation? **(1 mark)**

(d) Suggest other functions (Not in this investigation) that affect the action of an enzyme such as amylase. **(3 marks)**

16. Describe the various excretory organs and their respective wastes in man. **(10 marks)**

SECTION C: This section is compulsory. (15 marks)

17. The government of Rwanda is very much concerned about the destruction of our environment.
- (a) In what ways is the environment being destroyed? **(5 marks)** (b) Suggest possible ways of conserving it. **(10 marks)**

MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2005

Section A: Answer all questions

1. (a) A: Nucleus, B: Cytoplasm, C: Cell membrane.
(b) Bacterial infection can give a sore throat in that because bacteria releases toxins which stimulate the immune system to start inflammatory responses thus causing sensation of pain.

2. (a)

Gametes		Male	
		X	Y
Female	X	XX	XY
	X	XX	XY

Offspring genotype: 50 % XY; 50 % XX

Offspring phenotypes: 50 % are male; 50 % are female.

- (b) B: Chromosomes align (arrange themselves) in pairs along spindle fibres.
C: The microtubules attach chromosomes to the poles of the cell. D: Formation of a new cell membrane and cytoplasm.

3. (a) i) Asexual reproduction is a case where an organism reproduces without intervention of gametes. ii) Many plants need to be cross-pollinated though reproduce asexually because asexual reproduction does not allow genetic variation. The seedlings adapt badly with environment variation. The cross pollination helps the plant to reproduce sexually, thus helping in genetic variation.
4. (a) (i) Plants carry water up the plant by the xylem.
(ii) Plants lose water through leaves by transpiration.
(b) Marram grass is adapted to survive in dry conditions in the following ways:
 - Leaves fold to protect stoma (stomata are not exposed to the external environment).
 - Extensive root system.

- Leaf surface area very reduced to decrease the rate of transpiration. (c) Flowering plants should be cross pollinated because there is production of a unique combination of characters which confers seedlings more resistant to diseases.
5. (a) (i) **Pulmonary vein:** from the lungs to the heart.
Aorta: From the heart to the rest of the body.
(ii) Blood vessel from aorta towards the intestines, blood vessel from the intestines to the liver.
(b) Oxygen
6. (a) (i) The function of this sperm cell is to fertilize the female reproductive cell.
(ii) Part labelled A is used for propulsion of the spermatozoa towards the uterus. (b) (i) Nucleus ii) Chromosomes or genes carried by chromosomes.
7. Pointed canines, premolars and molars to cut, tear and grind meat.
8. (a) To digest starch into maltose.
(b)(i) To give optimum environment for functioning of enzyme pepsin. To convert pepsinogen into pepsin (ii) Pepsin, Renin.
9. (a) The body produces hormone (insulin) which facilitate the conversion of excess glucose into glycogen.
(b) The body produces hormone (glucagon) which converts glycogen into glucose, which increases blood glucose level.
10. (a) (i) Between 28°C and 35°C
The flowers grow more quickly between 28 and 35 but grow less below 28°C.
(b) Above 35°C, the temperature starts to destroy enzymes of chlorophyll (at high temperatures, the enzymes become denatured).
(c) The intensity of light or the level of carbon dioxide limits the rate of photosynthesis.
11. (a) A: Photosynthesis, B: Decomposition, C: Combustion, D: Nutrition,
(b) Burning trees (forests)
Burning fossil fuels.

Section B: Answer only three questions

12.(a) (i) A dominant allele is one which expresses itself in the phenotype of a heterozygous individual.

(ii) Homozygote

(b)(i) Pp for two cells since each receives (P of the mother, Anna and p for the father).

(ii) A recessive allele is one which is only expressed in the homozygous state.

(Or a recessive allele is an allele which is not expressed in the heterozygote).

(c) Genotype of the parents: Pp and pp Gametes: P , p , and p , p Punnet square:

Gametes		ale	
		P	p
Female	p	Pp	pp
	p	Pp	pp

The chance that their baby is polydactylous is 50 %.

13.(a) Small intestines.

(b) When bacteria enter in small intestine, they invade its epithelial lining. When bacteria die, they secrete toxins that irritate intestine's walls and this results into secretion of much water and salts that end up with diarrhoea.

(c) Virus or protozoa

(d) Lack of clean water, lack of hygiene, improper disposal of wastes, inadequate cooking utensils in order to get where to keep properly their food.

(e) The phagocytes engulf bacteria and ingest them.

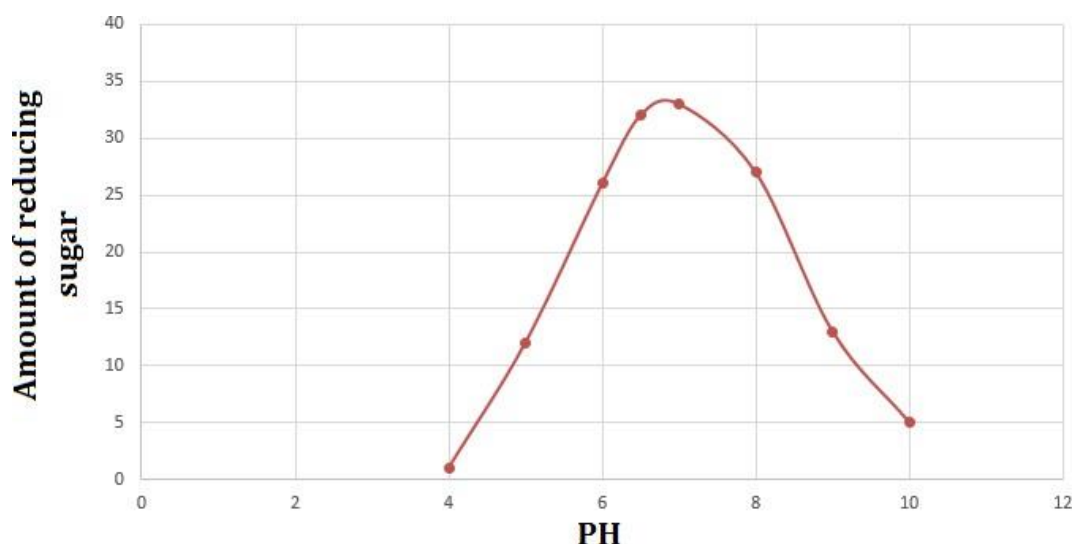
14.(a) (i) Petals: With their bright colours, petals attract insect pollinators

(ii) Stamens: These are male organs of the flowering plants formed of filament and anthers which cover or enclose the pollen grain.

(iii) Carpels: Female organ of flowering plants. Carpels are made up of stigma which receives pollen grains, the styles which are tubes.

(b) A mature pollen grain lands on a suitable and mature stigma of the same species. The pollen grain then grows to form a pollen tube which moves down the style up to the micropyle. Along the way, it divides to produce two haploid male nuclei. These then enter through the micropyle and one male nucleus fuses with a haploid egg to form a diploid zygote. The other nucleus then fuses with two polar nuclei to form a triploid cell called the endosperm.

15.(a)



(b) When the PH is low (0 to 4), the enzyme amylase is inactivated. Optimum functioning between PH = 6 and PH = 8, the largest activity being at PH = 7.

(c) The optimum level of PH of the enzyme amylase is of PH = 7.

(d) Temperature, concentration of the substrate, specific substrate.

16. Various excretory organs and their respective wastes:

EXCRETORY ORGANS	EXCRETORY PRODUCTS
Lungs	Carbon dioxide
Liver	Bile
Kidneys	Urea and uric acid
Skin	Sweat

SECTION C: THIS QUESTION IS COMPULSORY

17.(a) *Burning forests, increasing emission of carbon dioxide, Agricultural activities: destruction of vegetation cover, Deforestation (cutting trees), Erosion, utilization of pesticides and insecticides, use of non-biodegradable substances, use of non-renewable energy sources, poaching...*

(b) *Plant trees, avoid bush burning, fight against erosion, and check fuel quality, use of biodegradable substances; use of renewable energy sources, avoid poaching, Protection of national parks and game reserves, Protection against pollution.*

BIOLOGY III

002

07th Nov. 2006 08.30am –11.30am

REPUBLIC OF RWANDA



NATIONAL EXAMINATIONS COUNCIL
P.O.BOX 3817 KIGALI

ORDINARY LEVEL NATIONAL EXAMINATION 2006

SUBJECT: BIOLOGY III

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A**, **B** and **C**

Answer **ALL** questions in section A. **(55 marks)**

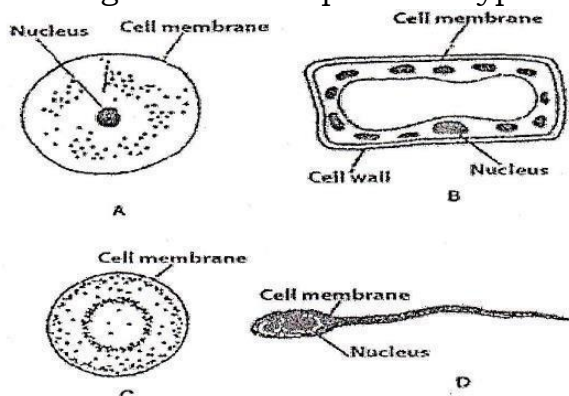
Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

SECTION A: ANSWER ALL QUESTIONS

(55 MARKS)

1. The diagram below represents types of cells.



Which of these represents animal cells? Explain your answer. **(3 marks)**

2. Using $\checkmark$ and X, indicate the parts of the cell found in a plant and animal cell. The first one has been done for you. **(5 marks)**

Part	Plant cell	Animal cell
Nucleus	$\checkmark$	$\checkmark$
Cell membrane		
Cytoplasm		
Cell wall		
Large vacuole		
Chloroplasts		

3. Photosynthesis takes place in cells containing chlorophyll.

- a) What colour is chlorophyll? **(1 mark)**
b) Where in a cell is chlorophyll found? **(1 mark)**
c) What is the function of chlorophyll? **(1 mark)**

4. Plants need mineral salts.

- a) Through which part do mineral salts get into the plant? **(1 mark)**
b) Explain why water is important in this process. **(2 marks)**

5. Copy and complete the table below **(5 marks)**

Mineral ions	Why needed in a plant	Effect if missing in soil
Nitrate		
Phosphate		

Potassium		
-----------	--	--

6. Blood contains plasma, platelets, red cells and white cells. Each has one or more important functions. Copy the table below and match each with its function. **(4 marks)**

Red cells	Fight bacteria
Platelets	Carry dissolved hormones
Plasma	Carry dissolved urea
White cells	Transport oxygen around the body.
	Helps blood to clot

7. For each of the following digestive substance, name the site of its production. **(4 marks)**

Digestive substance	Site of production
Bile	
Amylase	
Lipase	
Protease	

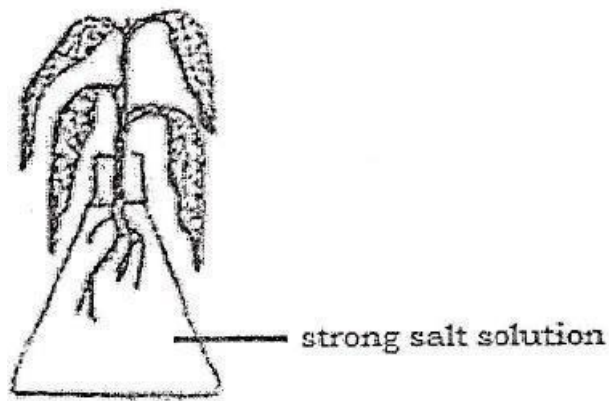
8. Describe how the liver helps to digest fats. **(2 marks)**
9. Red blood cells contain haemoglobin. Explain how this enables red blood cells to pick up oxygen from the alveoli and release it to the cells in other parts of the body. **(4 marks)**
10. The thickest muscular wall in the heart is that of the left ventricle. Why is this wall so thick? **(2 marks)**

11. Give THREE functions of the human skeleton. **(3 marks)**

12. (a) What is a synovial joint?
 (b) What function does each of the following have in a joint?
 (i) A tendon
 (ii) A ligament
 (iii) Synovial fluid
 (iv) A cartilage **(5 marks)**

13. In a pea plant the allele for being a tall plant (T) is dominant over the allele for being a dwarf plant (t).
 (a) Explain using a genetic diagram what would be produced if:
 (i) A homozygous tall plant is crossed with a homozygous dwarf plant. **(2 marks)**
(ii) Two plants from the crossing in (i) above were crossed. **(2 marks)**
(b) Why is it possible to have a heterozygous plant? **(2 marks)**

14. The diagram below shows what happens to a plant after 6 hours in a strong salt solution. Explain why the plant wilts.



SECTION B: Attempt any THREE questions in this section (30 marks)

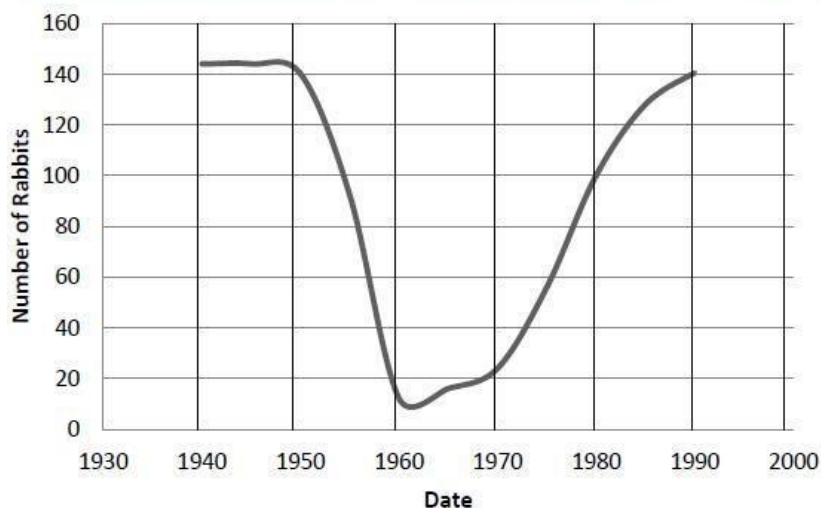
15. a) What draws water all the way from roots to the leaves of a plant? **(2 marks)** b)

What is transported along the xylem tissues? **(2 marks)**

c) What is transported along the phloem tissues? **(3 marks)**

d) Describe how cells become turgid but do not burst. **(3 marks)**

16. A population of rabbits lived on a small island. The graph below shows their population over the last 50 years.

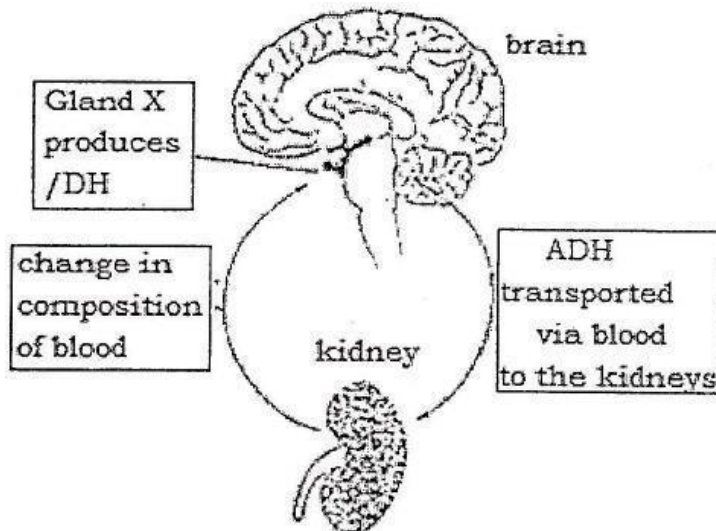


- a) (i) How many rabbits were there on the island in 1950? **(1 mark)**
 (ii) Give one year when there were 88 rabbits on the island. **(1 mark)**
- c) (i) Calculate the decrease in rabbit population between 1950 and 1960. **(1 mark)**
 (ii) Suggest reasons why the rabbit population fell in these years. **(3 marks)**

(d) (i) The population of rabbits increased after 1960. Suggest reasons why. **(2 marks)**

(ii) The highest number of rabbits on the island is always 140. Suggest reasons for this. **(2 marks)**

17. The diagram below shows some of the processes which control the composition of blood.



i) Name gland X. **(2 marks)** ii) What is the stimulus which cause gland X to produce ADH? **(2 marks)** iii) What is ADH and write it in full. **(3 marks)** iv) Describe the effect of an increase in ADH production on the kidney and on composition of urine. **(3 marks)**

18. a) How are hormones produced? **(1 mark)**

(b) How do hormones move around the body? **(1 mark)**

(c) Insulin and glucagon are hormones. Where are they produced?

(2 marks)

(d) Explain the roles of insulin and glucagon in controlling sugar levels.

(6 marks)

19. (i) In hot weather the diameter of the blood vessels supplying the capillaries in the skin changes. Explain how this change keeps us cool.

(4 marks)

(ii) Give other ways how the skin keeps us cool. **(3 marks)**

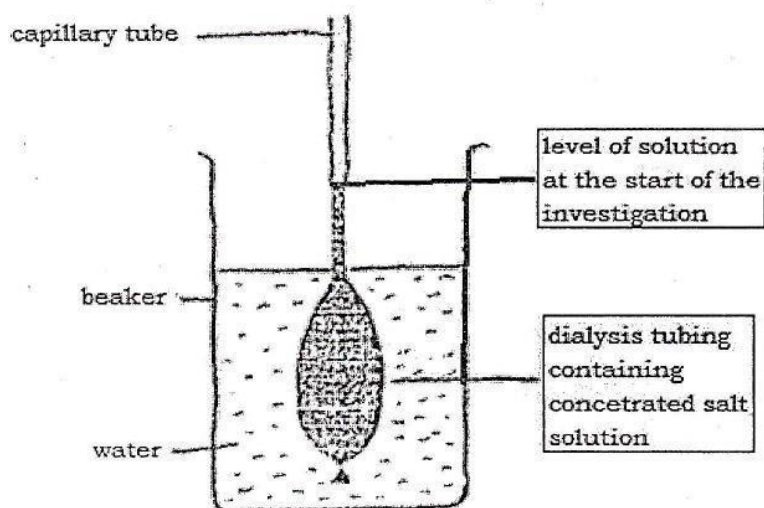
(iii) Give other functions of the skin. **(3 marks)**

SECTION C:

This section is compulsory

(15 marks)

20. Some students set up an experiment below to investigate osmosis.



- (a) i) Define osmosis. **(3 marks)** ii) What will happen to the water level in the capillary tube during investigation of osmosis? **(1 mark)** iii) Use your knowledge of osmosis to explain why this happens. **(3 marks)**

(5 marks)

- (b) A red blood cell when put in a beaker containing pure water eventually bursts but a plant cell never bursts in pure water. Using your knowledge of osmosis explain why this happens. **(6 marks)**

END.

MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2006

Section A: Answer all questions

1. A, C and D because they don't have a cell wall, a large central vacuole and chloroplasts.

2.

Part	Plant cell	Animal cell
Nucleus	√	√
Cell membrane	√	√
Cytoplasm	√	√
Cell wall	√	√
Large vacuole	√	X
Chloroplasts	√	X

3. (a) Green colour.
(b) In the chloroplast.

(c) Chlorophyll traps light energy.

4. (a) Through the roots

(b) Because mineral salts are in the solution with water and the entry of water by osmosis is done together with entry of mineral salts by diffusion.

5.

Mineral ions	Why needed in a plant	Effect if missing in soil
Nitrate	They are used in the synthesis of amino acids and proteins.	Decolouration of plant
Phosphate	Enter in composition of ATP and nucleic acid.	Small plants with poorly developed roots and small purple leaves
Potassium	Activation of certain enzymes in photosynthesis and respiration.	Leaves develop yellow and brownish margins and plant dies prematurely.

6.

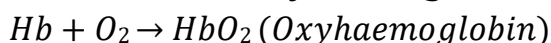
Blood elements	Functions
Red blood cells	Transport oxygen in all parts of the body
Platelets	Helps blood to clot
Plasma	Transports dissolved hormones and urea
White blood cells	Fight against bacteria

7.

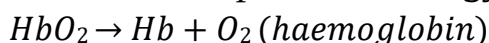
Digestive substance	Site of secretion
Bile	Liver
Amylase	Salivary glands and pancreas
Lipase	Pancreas
Protease	Stomach, pancreas and small intestines

8. The liver, using its bile emulsifies the fats (large fat droplets are cut into small droplet). This increases the surface area of fats and it becomes easier for lipase enzymes to digest them.

9. In the lungs (in the alveoli), haemoglobin combines with oxygen and becomes oxyhaemoglobin.



In the tissues, oxyhaemoglobin dissociates and releases oxygen to the cells to be used to produce energy.



10. Because the ventricles must contract with the great force to push the blood towards distant organs. The left ventricle pumps blood at great distance (to different tissues of the body) compared to the right ventricle which pumps blood to the lungs which are very close to the heart.

11. Protect certain organs like the brain, heart and lungs.

Helps in the formation of red blood cells.

Helps in movement.

Store minerals such as calcium and phosphorus

12. a) A synovial joint is a junction between 2 tissues containing a liquid which facilitates lubrication. b)

Parts of joint	Function
Tendon	Joins muscle to a bone
Ligament	Favours union between 2 bones
Synovial fluid	Reduces friction between two bones in a joint
Cartilage	Provides a smooth surface for joint movement; absorbs mechanical shocks.

13. a) (i) Parents: Tall plants x Dwarf plants

Tall: T; dwarf: t

Genotypes of parents: TT and tt

Gametes: T and T; t and t

Genetic diagram:

Gametes	T	T
t	Tt	Tt
t	Tt	Tt

Phenotype: 100 % tall

plants; Genotype: 100 %

Tt ii) Tt x Tt: Genetic diagram.

Gametes	T	t
T	TT	Tt
t	Tt	tt

Phenotype: 75 % tall plants; 25 % dwarf plants

Genotype: 25 % TT; 50 Tt; 25 % tt

(b) Because the allele for being dwarf is recessive.

14. The plant wilted because water moves from inside the plant to the more concentrated solution by osmosis. Water always moves from hypotonic solution (in this case the plant) to the hypertonic solution (strong salt solution) through a selectively membrane (the plasma membrane of plant cells).

SECTION B: Answer only three questions

15. (a) Transpiration, evaporation.

(b) Water and mineral salts

(c) Organic substances of food (elaborated sap)

(d) Water enters inside the plant cell until a certain limit. The cell wall prevents the plant cell from bursting.

16. (a) i) 140 rabbits ii) 1955

(b) i) The decrease of rabbit population between 1950 and 1960 is $140 - 12 = 128$ rabbits.

ii) Increase of the number of predators; disease; a density independent factor such as fire, hurricanes or flooding.

(c) (i) Decrease of the number of predators; availability of food; lack of diseases; less competition for water and space.

(ii) 140 rabbits is the carrying capacity of this ecosystem.

17. i) Gland X is the pituitary gland ii) Low levels of water in the blood or high levels of salt in blood.

iii) Anti Diuretic Hormone: It is a hormone produced by the pituitary gland in small quantities to cause reabsorption of water in the kidneys.

v) Increased ADH production causes more water to be reabsorbed back into blood causing the urine to be more concentrated and little in quantity.

18.(a) Hormones are produced by endocrine glands.

(b) Hormones move around the body in the **blood** to have an effect on other organs called **target organs**.

(c) Insulin and glucagon are produced in the pancreas.

(d) The body produces the insulin hormone to facilitate the conversion of excess glucose into glycogen; in the case of hyperglycaemia. The body produces the glucagon hormone which converts glycogen into glucose; in the case of hypoglycaemia (low blood glucose level).

19.i) When it is hot, there is an increase of diameter of blood vessels; vasodilatation; this increases the loss of heat from blood to the environment. It is thermoregulation favoured by vasodilation.

ii) Other ways by which the skin keeps us cool: By sweating; by lowering the skin hairs; by using fats stored in the skin. iii) Other function of the skin: Sensibility, Excretion, Production of vitamin D, Protection.

SECTION C: THIS QUESTION IS COMPULSORY

20.(a) i) Osmosis is the process by which water molecules move from less concentrated solution to a more concentrated one through a semi permeable membrane. ii) The water level in the capillary tube will increase. iii) The water level in the capillary tube will increase because the dialysis tubing contains concentrated salt solution. Water enters in the capillary tube. (b) When a red blood cell is placed in pure water, water enters it by osmosis via the semi-permeable membrane. As more water enters, the red blood cell swells more and more. However, the membrane found in this cell is not strong enough to withstand the turgor pressure that is caused by more water. The result is the cell bursting. On the other hand, the plant cell has got both the cell membrane and a cell wall. When water enters the plant cell; it will swell but the rigid and hard nature of the cell wall

creates an opposing force against the turgor pressure. This then prevents more water from entering thus the cell does not burst.

BIOLOGY III

002

02nd Nov. 2007 08.30am –11.30am

REPUBLIC OF RWANDA



NATIONAL EXAMINATIONS COUNCIL
P.O.BOX 3817 KIGALI

ORDINARY LEVEL NATIONAL EXAMINATION 2007

SUBJECT: BIOLOGY III

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A, B** and **C**

Answer **ALL** questions in section A. **(55 marks)**

Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

SECTION A: ANSWER ALL QUESTIONS

(55 MARKS)

1. (a) What is a cell?

(1 mark)

b) What are the main requirements of a cell if it is to survive? **(2 marks)**

2. a) Complete the classification of a man below: **(2 marks)**

Kingdom: Animalia

Phylum: Chordata

Class: Mammalia

Order: Primates Family:

.....

Genus:

Species: *Homo sapiens*

b) Define the term species. **(1 mark)**

3. What is meant by each of the following ecological terms?

i) A community **(1 mark)**

ii) A population **(1 mark)**

iii) A niche **(1 mark)**

4. a) Define the term pollination. **(1 mark)**

b) What are the characteristics of wind pollinated flowers? **(3 marks)**

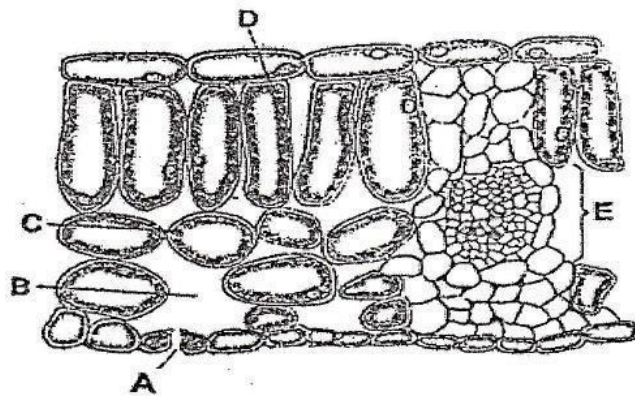
5. a) What is birth control? **(1 mark)**

b) Name any four methods used in birth control. **(4 marks)**

6. The table below refers to features of certain vitamins. Copy and complete the table with $\checkmark$ if the feature is correct and X if the feature is not correct. **(5 marks)**

Features	Vitamin A	Vitamin B
Fat soluble		
Present in wheat germ		
Present in green vegetables		
Promotes proper vision (right)		
Can be synthesized from Carotene in intestine		

7. The diagram below shows a cross section through a green leaf.



i) Identify the structures labelled A, B, C and D. **(4 marks)**

A:

B:

C:

D:

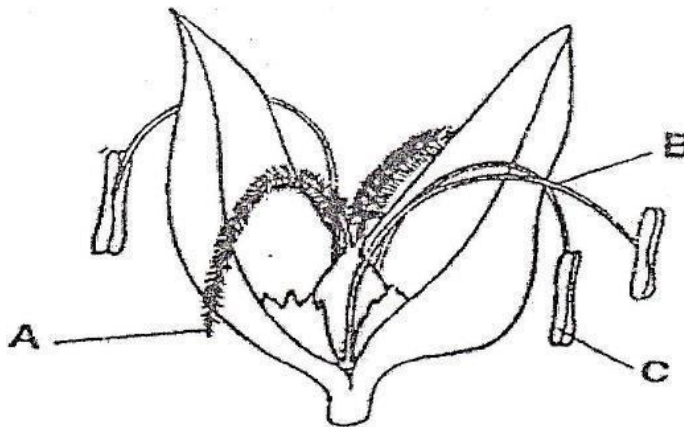
ii) What is the function of A and D? **(2 marks)**

8. a) Distinguish clearly between complete dominance and codominance. **(2 marks)** b)

Explain how a man with blood group A and a woman with blood group B can have a child with blood group O. **(2 marks)**

9. a) How does the skin of mammals help them to maintain a constant body temperature in cold conditions? **(2 marks)** b) Outline the advantages to a mammal of having a constant body temperature. **(2 marks)**

10. The diagram below shows the structure of a flower.



(i) Identify structures A, B and C. **(3 marks)**

A:

B:

C:

(ii) Describe the process of pollination that is likely to take place. **(2 marks)**

11. The blood of a normal person contains between 80-90mg of glucose per 100cm³. However, glucose level will rise. Where are the sources of glucose in the body? **(3 marks)**

12. The table below shows the number of organisms obtained at each trophic level in a sampling study of an acacia tree

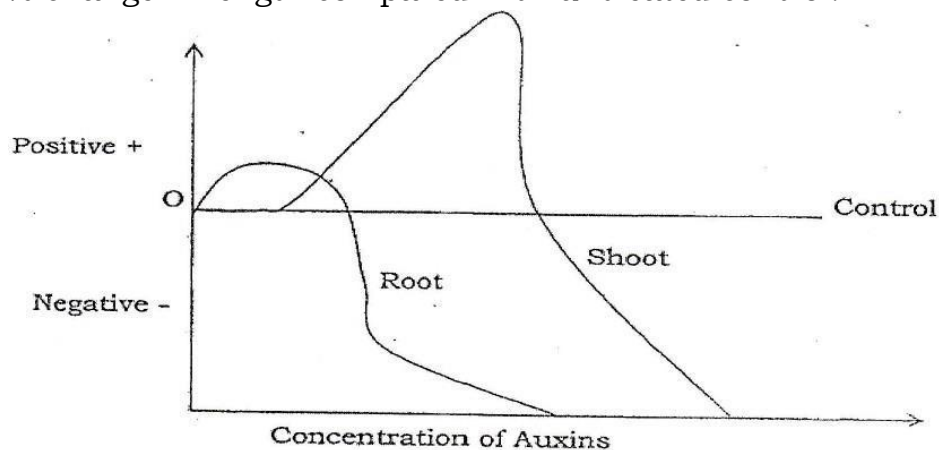
Trophic level	Number of organisms
Producer	1
Primary consumer	260.000
Secondary consumer	40
Tertiary consumer	3

- a) Draw a pyramid of biomass to represent this food chain. **(2 marks)**

- b) Suggest reasons why there is such a large difference between the number of primary and secondary consumers. **(2 marks)**

13. The graph shows the effect of applying different concentrations of auxin to roots and shoot of a plant. Use the graph to describe ways in which the responses of the root to auxin differs from the response of the shoot.

% change in length compared with untreated control.



(2 marks)

14. The table below refers to features of arteries, veins and capillaries. Copy the table. If the statement is correct, place a tick (✓) in the appropriate box and if the statement is wrong place a cross (X) in the appropriate box. **(3 marks)**

Features	Arteries	Veins	Capillaries
Walls permeable			
Collagen fibres present in walls			
Series of valves present.			

SECTION B: Attempt any THREE questions in this section. (30 marks)

15. Describe how water transport in a flowering plant takes place:

- a) From its uptake from soil by root hairs.
- b) Its transport up the stem to the leaves.
- c) Its evaporation from leaves into the atmosphere. **(10 marks)**

16. Xerophytic plants are adapted to live dry conditions. What features do these plants possess to enable them survive in such conditions?

Explain the role of each feature. **(10 marks)**

17. a) What are AIDS and HIV in full? **(2 marks)** b) What are the differences between AIDS and HIV? **(2 marks)**

c) (i) Describe how AIDS is spread from one person to another. **(2 marks)** (ii)

Suggest any two methods of how the disease can be reduced.

(4 marks)

18. (a) What are the main excretory organs and their respective excretory products in animals? **(5 marks)**

(b) Plants do not have excretory systems like animals. Why is this so? **(4 marks)**

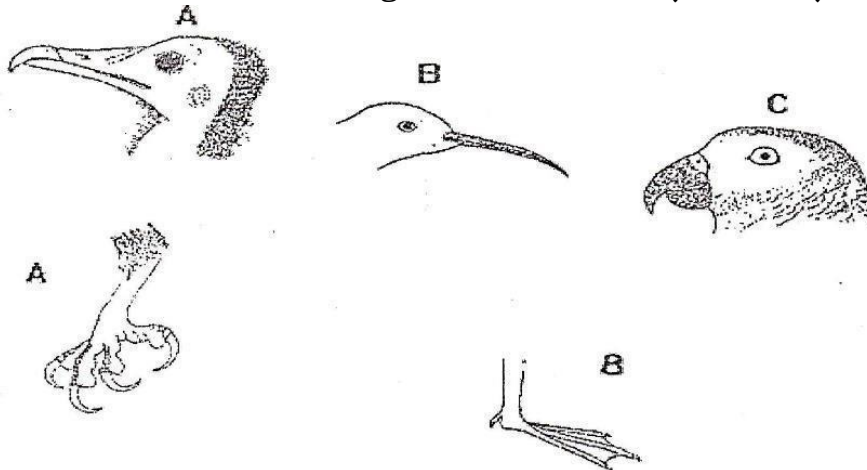
19. (a) What are the differences between vegetative and sexual reproduction in plants? **(5 marks)**

(b) What advantage does each type have over the other? **(5 marks)**

SECTION C: Answer only one question

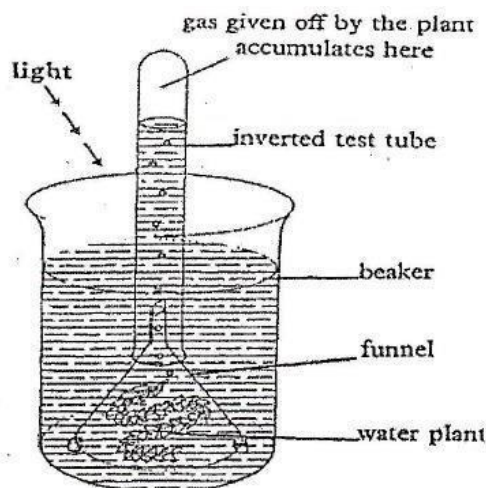
(15 marks)

20. a) For each of the bird's beak and feet below, describe their adaptations to the methods of feeding and locomotion. **(5 marks)**



b) Which features adapt birds for flying? **(10 marks)**

21. A group of students carried out the experiment below to investigate whether oxygen is given by plants during a biological process.



- (i) Name the biological process being investigated. **(2 marks)** (ii) What conditions are necessary for that process you have named above? **(5 marks)** (iii)

Describe in detail how the process works until its final products are formed. **(8 marks)**

MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2007

Section A: Answer all questions

1. (a) *This is the smallest unit of all living organisms. The cell is the smallest unit that is capable of carrying out life processes.* (b) *It must have oxygen in order to respire. It must have energy giving food e.g. glucose It must be able to get rid of waste products. It must have water for proper functioning of the body.*
2. (a) *Family: Hominidae*
Genus: Homo
 (b) *This is a group of closely related organisms that can interbreed and produce fertile offspring.*
3. (i) *A community is a group of different populations living together in an environment.*
 (ii) *A population: is a group of organisms of the same species living in the same environment.*
 (iii) *A niche: Is the role an organism plays in an environment.*
4. (a) *Pollination is the transfer of pollen grains to a stigma of a flower.*
 (b) *Characteristics of wind pollinated flowers:*
They produce many pollen grains, they have dull coloured petals, they don't have nectar, and their pollen grains are light.

5. (a) This refers to the mechanism used to regulate the number of children in a family.
- (b) Types of birth control methods include; Vasectomy, tubal ligation in females, use of condoms, abstinence from sexual activity, use of pills, withdrawal method.

6.

Features	Vitamin A	Vitamin B
<i>Fat soluble</i>	√	X
<i>Present in wheat germ</i>	X	√
<i>Present in green vegetables</i>	X	√
<i>Promotes proper vision (right)</i>	√	X
<i>Can be synthesized from Carotene in intestine</i>	√	X

7. (i) A – Stoma B - Air space
C- Spongy mesophyll cell
D - Palisade mesophyll cell
- (ii) A - To allow entry and exit of gases.
D - To carry out photosynthesis.

8. (a) Complete dominance is where one allele (dominant) completely masks the presence of another allele (recessive) in the phenotype of an organism while incomplete dominance is where two different alleles don't mask either hence both show their presence in the phenotype.

In complete dominance, the dominant allele appears in the heterozygote whereas in incomplete dominance the heterozygote has a third genotype which is different from that of both parents. (a) Let I represent the allele for blood groups.

Let I^A represent the allele for blood group A

Let I^B represent the allele for blood group B

Let I^O represent the allele for blood group O

Parental phenotype: Blood group A X Blood group B

Parental genotype: $I^A I^O$ X $I^B I^O$ or AO X BO

Gametes: I^A , I^O and I^B , I^O

	A	O
Gametes	I	I
I _B	I _A I _B	I _B I _O
I _O	I _A I _O	I _O I _O

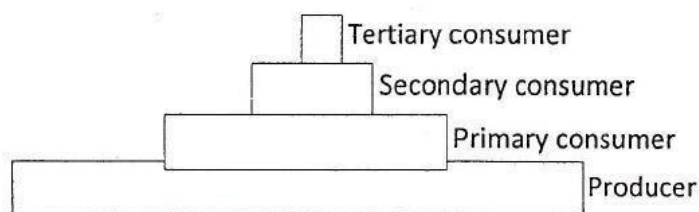
Blood groups of children: 25 % group AB; 25 % group B; 25 % group A; 25 % group O.

Or

Gametes	A	O
B	AB	BO
O	AO	OO

Blood groups of children: 25 % group AB; 25 % group B; 25 % group A; 25 % group O.

9. (a) It has hairs which stand upright to trap warm air around the skin. It can have the arteries undergo vasoconstriction, hence minimising heat loss over the skin.
 (b) It enables the organism to work in both cold and hot conditions. It enables the organisms colonise different habitats.
- 10.(i) A: Stigma B: Filament
 C: Anther head
 (ii) It is wind pollinated. This is because the anther heads and stigma are all projecting outwards.
11. Sources of glucose include:
- From food eaten containing glucose e.g. Irish potatoes □
 From converting stored glycogen into glucose.
 - From converting stored fats into glucose
- 12.(a) Pyramid of biomass



- (b) The number of primary consumers is much bigger than secondary consumers because primary consumers are parasites. The parasites are usually smaller. This is indicated by the fact

that one tree (producer) can feed up to 260 000 primary consumers.

13. Response in roots: Low levels of auxins in the roots promote elongation while high levels inhibit root elongation.

Response in shoots: Low levels of auxins in the shoot inhibit its elongation while high levels of auxins in the shoot promote elongation.

14.

Features	Arteries	Veins	Capillaries
Walls permeable	X	X	√
Collagen fibres present in walls	√	√	X
Series of valves present.	X	√	X

SECTION B: Attempt any THREE questions in this section.

15.(a) It occurs by osmosis. This is because; the root hairs have more solutes in their sap and are semi - permeable thus causing water to enter by osmosis.

(b) It moves up with the help of three forces, i.e. Transpiration pull, Capillarity effect and Root pressure.

- Transpiration pull is caused by the evaporation of water off the leaves thus causing water to move as a long column.
- Capillarity effect is caused when the two opposite forces of cohesion and adhesion interact.
- The result will be water moving up without breaking.
- Root pressure is caused when water moves up due the pressure caused by the apoplast Pathway being blocked.

(c) When light strikes a leaf, it causes the water in the spongy / mesophyll cells to move out.

This causes it to change into vapour hence moves out through the stomata.

16. Feature of xerophytic plants have to adapt in dry conditions

- Have a thick cuticle to prevent cuticular transpiration.
- They have deep roots that are able to absorb water from deep layers.

- They have surface roots to absorb water that falls during brief rainfalls.
- Some open their stomata at night to prevent loss of water during the day.
- Some have reduced leaves into thorns to minimise water loss.
- Some have hairy stomata to prevent excessive evaporation of water.
- Some roll their leaves to minimise water loss through stomata.
- Some have sunken stomata to prevent loss of water through stomata.
- Some have thick and fleshy leaves to store water.
- Some shade their leaves when conditions are harsh.

17.(a) AIDS: Acquired Immune Deficiency Syndrome

HIV: Human Immune Virus

(b) AIDS is the disease caused by HIV while HIV is the virus that causes AIDS.

(c) (i) Through having unprotected sex with an infected person. Some secretions such as vaginal secretions and semen containing HIV get exchanged thus getting AIDS.

During birth when an infected mother passes on the HIV to the baby. Through sharing sharp objects with an infected person. These objects contain blood, thus infecting other people.

(ii) Through having protected sex (use of condoms) Through being faithful to one partner among the married. Avoiding use of sharp objects

18.(a) Skin: sweat

Kidneys: urea

Lungs: carbon dioxide

Malpighian tubules: uric acid

Flame cells: ammonia

(b) Plants have low metabolic rates compared to animals hence produce few wastes.

Plants are producers hence don't produce many wastes.

Plants have the ability to use their wastes in other reactions
e.g. Carbon dioxide from respiration is used as a raw materials in photosynthesis and the reverse is true.

Some waste products are stored in plants in non-toxic form,

19.(a) Differences between vegetative and sexual reproduction

Vegetative reproduction	Sexual reproduction
Involves one parent	Involves two parents
There is no fusion of gametes	There is fusion of gametes
Produces many offspring	Produces fewer offspring
It takes a short time	It takes a long time
Involves mitosis	Involves meiosis

(b) **Advantages of sexual reproduction**

It introduces genetic variation in the offspring.

The offspring are well protected

Advantages of vegetative reproduction

It does not require the search for mates. Many off springs are produced quickly. It requires less energy.

SECTION C: Answer one question only

20.(a) **Beak A and feet A:** It is adapted for catching and killing prey. This is because of sharp, hooked beaks. The legs also have claws for holding the prey tightly. All these bite the skull or neck and also to tear the body into pieces small enough to swallow.

Beak B and leg B: it is adapted for eating fish. This is because of the sharp tooth-like structures on the edge of the bill to hold fish tightly. Its leg is also webbed for swimming in water while looking for fish.

Bird C: It is adapted for cracking seeds. This is because it looks big hence strong.

(b) **Features which adapt birds for flying.**

- They have hollow bones to reduce weight while flying.
- They have wings for flight.
- They lack external ears to minimize air resistance while flying.

- They have feathers which strong yet light for easy flying.
- They have air sacs which store air during flight.
- They have strong pectoral muscles for flight.
- They have a streamlined body for easy movement in air.
- They can retract their legs when in air to avoid air resistance.
- They have a fast beating heart to ensure efficient gaseous exchange.
- They have eyes located on the front part of the head for easy seeing when flying.

21.(i) The biological process is **Photosynthesis**.

(ii) Carbon dioxide, Sunlight, Chlorophyll, Water, Optimum temperature (iii) Sunlight strikes chlorophyll molecules causing electrons to get excited thus producing energy rich compounds in the form of ATP and NADPH in the light dependent reactions of photosynthesis. Oxygen is also produced as a waste product. The light independent reactions follows and occurs in the stroma of chloroplasts.

It involves three stages:

- **Carbon fixation:** Here, Carbon dioxide from the atmosphere combines with RUBP (Ribulose biphosphate) to form an unstable six compound. The six carbon compound then divides into two forming PGA (Phosphoglyceric acid).
- **Reduction:** PGA is then reduced by ATP and NADPH to form PGAL (Phosphoglceraldehyde) also called glyceraldehyde-3-phosphate.
- **Regeneration of RuBP:** PGAL then combines to form more RUBP Product. Some PGAL also combines with itself to form a hexose sugar that gives rise to glucose and other products such as starch, proteins and lipids.



BIOLOGY III

002

07th Nov. 2008 08.30 – 11.30 am

ORDINARY LEVEL NATIONAL EXAMINATION 2008

SUBJECT: BIOLOGY III

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A**, **B** and **C**

Answer **ALL** questions in section A. **(55 marks)**

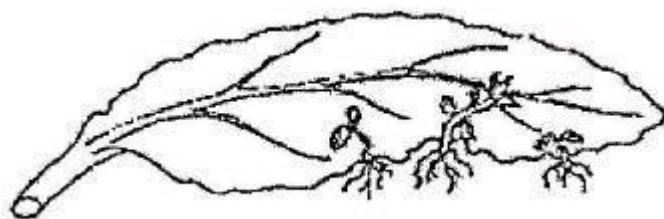
Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

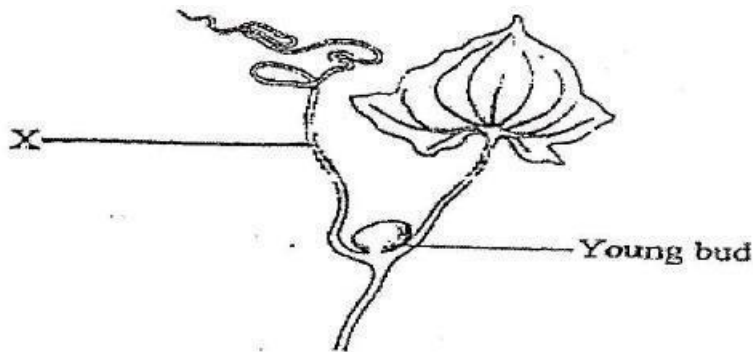
SECTION A: ANSWER ALL QUESTIONS **(55 MARKS)**

1. (a) Explain what it means when a person is said to be HIV positive.
(1 mark)
(b) Name three common ways HIV/AIDS can be transmitted from one person to another.
(3 marks)

2. Explain why:
 - (a) Babies need a high proportion of protein in their diet than adults. **(2 marks)**
 - (b) Marathon runners need a high proportion of carbohydrates. **(2 marks)**
3. (a) What is the function of a root? **(1 mark)**
 - (b) Explain the significance of root hairs. **(1 mark)**
 - (c) Explain why the proteins in cell membranes are globular rather than fibrous. **(2 marks)**
4. Name the primary nitrogenous excretory products in the following organisms. **(4 marks)**
 - (a) Man
 - (b) Lizard
 - (c) Fish
 - (d) Insects
5. (a) Define an ecosystem. **(1 mark)**
 - (b) Explain the role of producers to the functioning of an ecosystem. **(3 marks)**
6. The diagram below shows a bryophyllum leaf carrying out a biological process.



- (a) Name this biological process. **(1 mark)**
 - (b) Give one advantage and disadvantage of this process. **(2 marks)**
7. (a) Briefly explain the role of the following in germination:
 - i) Water ii) Oxygen
 - iii) Gibberellic acid. **(3 marks)**
 - (b) An adult man needs about 60g of protein per day. Why does he gain nothing if he eats more than this? **(2 marks)**
8. (a) Describe two ways in which plants manage to attract animal pollinators. **(2 marks)**
 - (b) Compare the efficiency (effectiveness) of wind and insect pollination. Give a reason for your answer. **(3 marks)**
9. The diagram below shows a leaf of a wild yam.



a) Label the structure X. **(1 mark)**

b) What is the function of X? **(1 mark)**

10. a) Explain what is meant by the term: **(2 marks)**

- i) Diastole ii)
- Systole

b) Explain how the body manages to increase the rate of blood flow during exercise. **(2 marks)**

11. The diagram below shows a cactus plant.



What features does this plant have to show that it is a desert plant?

(3 marks)

12. (a) The leaf surface is covered with a waxy cuticle. Explain why. **(1 mark) (b)**

Explain why the epidermis of a leaf is transparent. **(1 mark)**

(c) Explain why leaves are usually broad and flat. **(2 marks)**

13. Define the following terms:

a) Metamorphosis.

b) Moulting

c) Instar **(3 marks)**

14. (a) Diabetes insipidus is one type of diabetes caused by ADH. Based on what you know on the role of ADH in kidney function, describe the symptoms of this disease. **(2 marks)**

- (b) Suggest how this disease might be treated. **(1 mark)** (c) Explain why alcohol consumption in excess causes dehydration and thirst. **(2 marks)**

15. The table below shows the diploid number of chromosomes in the cell of some organisms.

Organisms	Diploid number
Human	46
Pea	14
Mouse	40
Maize	20

(a) Define the terms:

Diploid

(1 mark)

Haploid

(1 mark)

(b) What is the haploid number of chromosomes in a mouse? **(1 mark)**

(c) How many chromosomes would you find in a leaf cell of a pea? **(1 mark)**

SECTION B: Answer only THREE questions. (30 marks)

16. (a) Although Ebola is a dangerous disease, it is probably less likely to cause as many deaths as the HIV/AIDS pandemic. Explain why AIDS has greater potential to kill a large proportion of the world population.

(6 marks)

(b) Suggest ways in which people in your village could reduce the occurrence of malaria carrying mosquitoes in their immediate area.

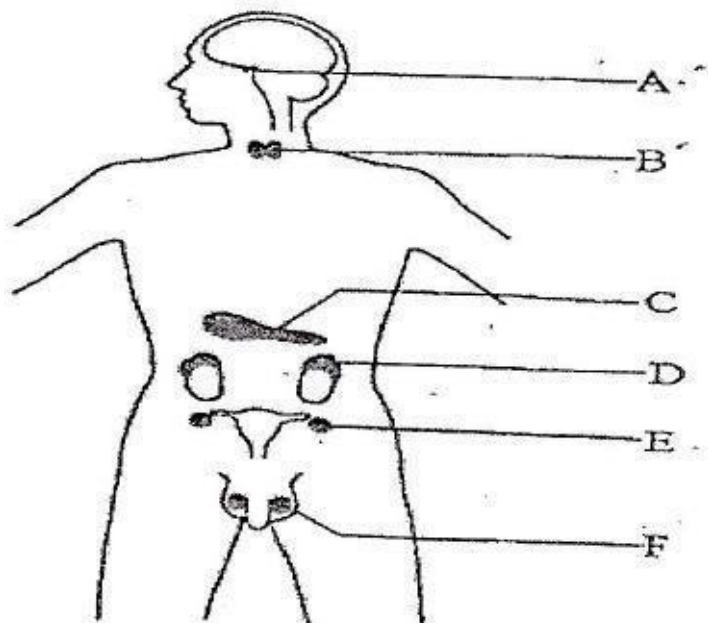
(4 marks)

17. (a) The xylem and phloem of the root are continuous with the phloem and phloem of the stem and leaves. Explain why this continuous system of tubes is necessary for the plant. **(7 marks)**

(b) Explain why it is necessary for a root tip to be covered with a protective cap of cells. **(3 marks)**

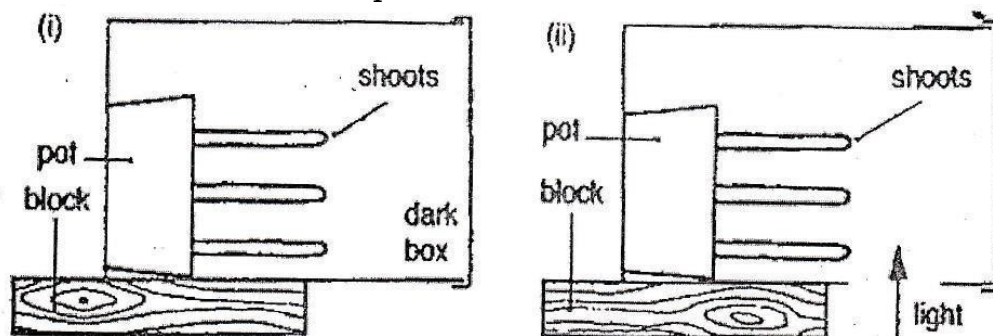
18. (a) Describe some of the potential disadvantages of reproducing asexually and advantages of reproducing sexually. **(8 marks)** (b) What is parthenogenesis? **(2 marks)**

19. The diagram below shows the position of the endocrine glands in humans.



- (a) Name glands A - F. (6 marks)
 (b) Name some of the hormones produced by gland A. (2 marks)
 (c) What are the functions of the insulin hormone? (2 marks)

20. Two containers are set up as shown below.



- (a) Describe why they are set up as they are. (5 marks) (b) Describe what will happen in each case. (5 marks) **SECTION C: Answer only ONE question. (15 marks)**

21. The following table gives data for the rate of blood flow to various parts of the body at rest and during heavy exercise.

ORGAN OR TISSUE	AT REST		HEAVY EXERCISE	
	Cm ³ min ⁻¹	% of total	Cm ³ min ⁻¹	% of total
Brain	700	14 %	750	4.2 %
Heart	200	 %	750	 %
Lung tissue	100	 %	200	 %
Kidney	1,100	 %	600	 %
Liver	1,350	 %	600	 %

Skeletal	750	 %	12,500	 %
Muscle	250	 %	250	 %
Bone	300	 %	1900	 %
Skin	50	 %	50	 %
Thyroid gland	25	 %	25	 %
Adrenal gland	175	 %	175	 %
Other tissues				
TOTAL	5,000	100 %	17,800	100

- (a) Calculate the percentage of the total blood flow that each organ or tissue receives under each regime of activity. **(10 marks)**
- (b) Compare the blood flow to the kidney, liver and skeletal muscle and skin during both activities. Explain your answer. **(5 marks)**

22. (a) Why are enzymes important? **(5 marks)**

- (b) List down the characteristics of enzymes. For three characteristics, describe controlled experiments which you can perform to demonstrate the characteristic. **(10 marks)**

MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2008

Section A: Answer all questions

- (a) *HIV positive person: a person who has HIV virus in his blood.*

(b) *Ways of transmitting HIV/AIDS:*
Blood transfusion,
By sharing sharp objects,
Through vaginal secretions,
Across the placenta (through exchange of materials), Mother to child during birth,
Through unprotected sex.
- (a) *Babies need a high proportion of proteins because they are body building foods and babies are growing.*

(b) *For obtaining a large amount of energy needed for muscle activity.*
- (a) *Roots hold the plant firm in the ground; they absorb water and minerals; they swell and accumulate food reserves.*

(b) *Root hairs increase the surface area for absorption of water and mineral salts.*

(c) *This is because globular proteins are flexible and easily movable hence constitute the property of a cell membrane.*

However, fibrous proteins are rigid and non-movable and cannot move the part of a cell membrane.

4.
 - a) Urea
 - b) Uric acid
 - c) Ammonia
 - d) Uric acid

5.
 - a) An ecosystem is a set of biotic components interacting with each other to form a self-sustaining unit.
 - b) They trap solar energy and convert it into chemical energy as food which is passed on to higher consumers; they provide food to primary consumers.

6.
 - a) Vegetative propagation (asexual reproduction).
 - b) Advantage: The new young plants can be formed very fast (i.e. produces many offspring at once)
Disadvantage: It maintains poor quality / variety of yields.

7.
 - a)
 - i) Water helps to activate enzymes in the seeds to start breaking down stored food. It also helps the cells swell hence growth occurs.
 - (ii) Oxygen is used in aerobic respiration to produce energy.
 - (iii) Gibberellic acid is a growth substance which helps to break seed dormancy.
 - b) This is because the extra grams eaten will not be stored in the body but the amino group will be converted into ammonia. Ammonia will also be converted into urea which is excreted out of the body. The remaining part will be converted into a carbohydrate which can be used to produce the energy or that can be stored.

8.
 - a) Some have brightly coloured petals which attract animals like bees. Some have nectar which draws many animals like bees.
 - b) Insect pollination is more efficient as it uses fewer pollen grains and ensures that they land on the appropriate stigma while wind pollination uses many pollen grains and has fewer chances of reaching the stigma.

9. a) Tendril

b) To provide extra mechanical support to the plant.

10.a)) i) It refers to the relaxation of the heart muscle.

ii) Systole is the contraction of the heart muscle.

b) Through the increased pumping action of the heart. Also the body can cause vasoconstriction in the artery walls. This narrows the lumen thus increasing the pressure and rate at which blood flows.

11.- It has thorns which are modified leaves to minimize the rate of transpiration. , - It is succulent (fleshy) to store food and water for the plant.

- It is large to increase the surface area for absorption of sunlight.

12.a) This is meant to minimize water loss through the cuticle.

b) To allow light penetrate to deep layers in order to carry out photosynthesis.

c) They are broad increase the surface area for trapping sunlight. They are flat to ensure easy penetration of light up to the lower layers.

13.(a) This is a gradual process of growth in insects that involves changing form and shape from one stage to another e.g. egg to larva to pupa and then adult.

b) This is the periodic shedding off of the exoskeleton in arthropods. (c) This is the life style of an insect between two moults.

14.Frequent urination i.e. always going to the toilet in short period; producing a large amount of urine; feeling thirsty often. (b) Administering the patient with ADH

(c) This is because when one takes alcohol, it inhibits or prevents the production of ADH. This then causes the person to lose a lot of water through urine. The final result is that the person feels dehydrated the next morning.

15.(a) (i) Diploid refers to a condition where two sets of homologous chromosomes exist inside the organism's nucleus.

(ii) *Haploid is a condition in which an organism has one set of the homologous chromosomes.*

b) 20

c) 14

SECTION B: Attempt any THREE questions in this section.

16.(a) *AIDS has a greater potential to kill a large population because of the following reasons:*

- *AIDS is a disease that comes after one's immune system is down, In this way, a sick person will easily die because the HIV virus will have destroyed all his/her white blood cells. In this case, the victim will die faster.*

- *HIV is becoming resistant to anti retro viral drugs which make it hard to find a cure. In this way a sick person, will not recover but remain sick and die.* - *HIV/AIDS is transmitted mainly through sexual intercourse and many young people engage in sex a lot. In this way if one is sick and has unprotected sex with many friends, ends up transmitting the virus hence more deaths.*

- *AIDS takes some time to kill its victim. In this way, the sick person will keep infecting more people if he/she has unprotected sexual intercourse with those not sick.*

b) - *Getting rid of bushes around the homes.*

- *Removing stagnant water around people's homes.*

- *Closing doors and windows early.*

- *Spraying the room with insecticides before using them.* - *Sleeping under an insect treated mosquito net.*

17.(a) *The continuous system of tubes ensures that water and mineral salts can be transported both to and from the roots and leaves. It also ensures that manufactured food can be transported from the leaves to roots and back. Also the system provides mechanical support to the plant.*

b) *This is meant to protect the tip from damage as it grows down the soil.*

18.(a) **Disadvantages of asexual reproduction**

- It does not introduce variation among the offspring.
- If the parent has a genetic disease, then it will be passed on to the offspring.

Advantages of sexual reproduction

- It introduces variation among the offspring.
 - It makes the offspring unique.
 - The organism to be born is often well protected by the parents.
- (b) This is a type of reproduction which involves formation of new offspring from unfertilised eggs. It is common in some animals such as bees and aphids.

19.(a) A – Pituitary gland

B - Thyroid gland

C – Pancreas

D- Adrenal gland

E – Ovary

F – Testis

b) - ADH, Oxytocin, Thyroid stimulating hormone, Growth hormone

c) It lower the levels of blood glucose back to normal; it converts glucose into glycogen.

- It increases the rate of respiration

20.(a) Setup (i) is placed in a completely closed dark box which means light will not be able to enter and reach the shoots while set up (ii) was placed in a black box with an opening for light to enter on the side. Also, both set ups are placed lying down horizontally. The shoots are growing in a pot.

b) In set up (i), the shoots will grow faster and bend upwards in search for light. This will be due to the auxins moving downwards on the shoot thus causing the rapid elongation on that side. However for setup (ii) the shoots will grow bending downwards in the direction of light.

SECTION C: Answer only ONE question.

21.(a) Table showing the percentage of total blood flow

ORGAN OR TISSUE	AT REST		HEAVY EXERCISE	
	$\text{Cm}_3\text{min}^{-1}$	% of total	$\text{Cm}_3\text{min}^{-1}$	% of total
Brain	700	14 %	750	4.2 %
Heart	200	4 %	750	4.2
Lung tissue	100	2 %	200	1.1 %
Kidney	1,100	22 %	600	3.4 %
Liver	1,350	27 %	600	3.4 %
Skeletal	750	15 %	12,500	70.2 %
Muscle	250	5 %	250	1.4 %
Bone	300	6 %	1900	10.7 %
Skin	50	1 %	50	0.3 %
Thyroid gland	25	0.5 %	25	0.1 %
Adrenal gland	175	3.5 %	175	1 %
Other tissues				
TOTAL	5,000	100 %	17,800	100

b) **Kidney:** There is a decrease in blood flowing during heavy exercise compared to that at rest. This is because most blood is needed in other parts of the body than the kidney for filtering.

Liver: There is a decrease also in blood flowing during exercise compared to that at rest. This is because digestion process is slowed down thus less blood flows to the liver.

Skeletal muscle: There is big increase in blood. This is because muscles need a lot of nutrients like glucose and oxygen for rapid contraction during heavy exercise.

Skin: There is a slight decrease. This is because the arteries constrict to ensure less blood flows to the skin but to vital organs like the muscles.

22.(a)

- They form and break bonds in food substrates thus help in digestion.
- They increase the rate of metabolic reactions.
- In their reactions, they generate heat which keeps an organism warm.
- Some are used in lysosomes to destroy foreign bodies/germs.

b) **Characteristics of enzymes**

- They are protein in nature; they catalyze both forward and backward reactions; they are affected by high temperatures and very low temperatures; they work at particular pH ranges; they work well in low concentrations; they are globular in nature.

An experiment to show that enzymes work at specific temperature

Apparatus: Test tubes, heat source, Starch solution, Thermometer, Fresh saliva extract, Benedict's solution, Iodine solution

Procedure

Place 3cm³ of fresh saliva in each of the two test tubes and label them A and B. Pour 2cm³ of starch solution in each test tube.

Place test tube A in warm water bath at 35°C for 30 minutes while test tube B in a water bath at 100°C also for 30 minutes.

After obtain 2cm³ from test tube A & B, into two separate clean test tubes and add 2 drops of iodine solution. Observe.

Also, obtain 2cm³ from test tube A & B, into two separate clean test tubes and add 2 cm³ of Benedict's solution and heat for 1 minute.

Observation

Iodine test: in test tube B, the colour of iodine remained brown (starch absent) while in test tube A the colour of iodine turned blue-black (starch present).

Reducing sugar test: in test tube A, the blue colours of Benedict's solution turned blue to green to yellow then red brown (reducing sugars are present) while test tube B the blue colour of Benedict's solution doesn't change (reducing sugars are absent).

Conclusion

Test tube A had saliva amylase work best at 35°C hence converted starch to maltose while test tube B was subjected to high temperatures which denatured the enzyme.



BIOLOGY I

002

06th Nov. 2009 08.30 – 11.30 am

ORDINARY LEVEL NATIONAL EXAMINATION 2009

SUBJECT: BIOLOGY I

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A**, **B** and **C**

Answer **ALL** questions in section A. **(55 marks)**

Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

SECTION A: ANSWER ALL QUESTIONS (55 MARKS)

1. Give three characteristics of class Amphibia. **(3 marks)**
2. What are the functions of the following structures?

- i) Pancreas ii)
Muscles
iii) Gills

(3 marks)

3. Match the structures with the organisms which possess them. **(4 marks)**

Structures	Organisms
Antennae	Fungus
Flagella	Snail
Spores	Housefly
Coiled shell	Euglena

4. Amoeba is a single celled organism which lives in water. Describe how it feeds.
(3 marks)

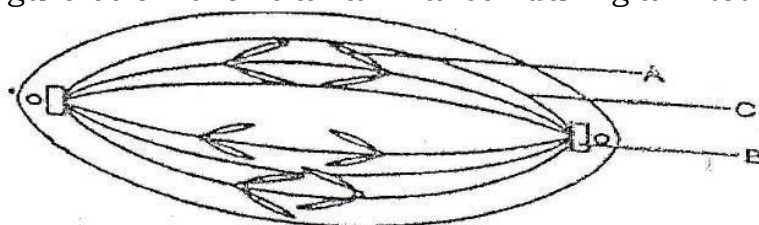
5. (a) Describe four common features of a respiratory surface in animals.
(2 marks)

(b) What advantage does aerobic respiration have over anaerobic respiration?
(2 marks)

6. (a) Define osmosis. **(2 marks)**

(b) Explain why osmosis is considered a special case of diffusion.
(2 marks)

The figure below shows an animal cell during a mitotic division.



- i) Name the structures A, B and C. **(3 marks)** ii) What stage of mitosis is shown in the figure? **(1 mark)** iii) State two roles of mitosis. **(2 marks)**

8. (a) Explain why there is no digestion of starch in the stomach. **(2 marks)**
(b) Enzymes are specific. Explain this statement. **(2 marks)**

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

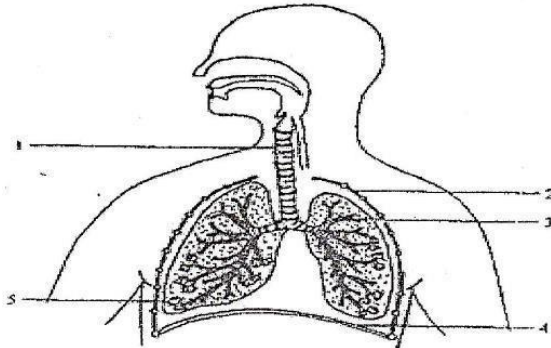
Explain why large organisms need a circulatory system. **(2 marks)**

10. The following interconversions take place during metabolism of carbohydrates in a human body



- (a) In which organ does this reaction take place? **(1 mark)**
 (b) Name two hormones that are involved in this reaction. **(2 marks)**
 (c) What is the effect of excess glucose in the blood? **(2 marks)**

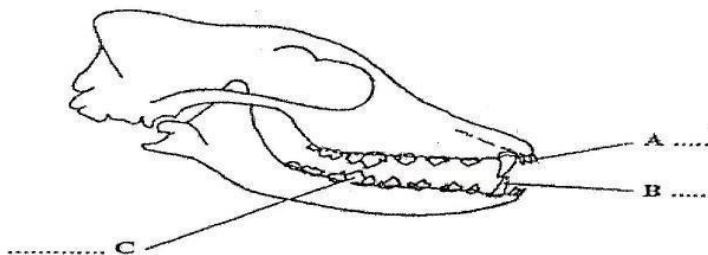
11. The diagram below shows some parts in the human thorax.



- (a) Label the numerated parts in the thorax by completing the table below. **(5 marks)**

Numbers	Name of part
1	
2	
3	
4	
5	

12. The diagram below shows the side view of the skull of a carnivore.



- (a) Label the teeth A, B, and C. **(3 marks)**
 (b) What function does each of the types of teeth mentioned in (a) above perform in helping this carnivore feed? **(3 marks)**
 A.....
 B.....
 C.....
 (c) The jaw movement of carnivores and herbivores are different because they feed on different kinds of food.
 i) Describe the jaw movement of a carnivore. **(1 mark)** ii) Describe the jaw action of a herbivore. **(1 mark)**

13. In mice, the gene for black fur is dominant over the gene for brown fur. The gene for black fur can be represented by "B" while "b" represents the gene for brown fur.

(a) What is the genotype of a brown mouse? **(1 mark)**

(b) What are the possible genotypes of a black mouse? **(2 marks) SECTION B:**

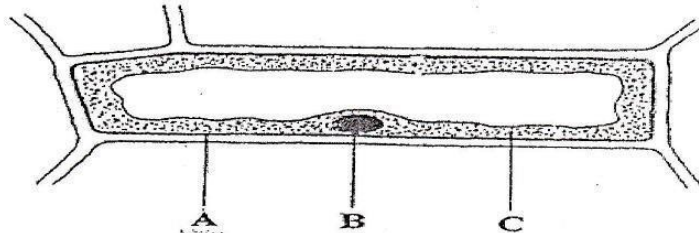
Attempt any THREE questions in this section. (30 marks)

14. (a) Define photosynthesis. **(1 mark)**

(b) What are the raw materials of photosynthesis? **(2 marks)** (c) Explain how a leaf is adapted to photosynthesis. **(4 marks)** (d) Mention three factors that may influence the rate of photosynthesis.

(3 marks) 15.

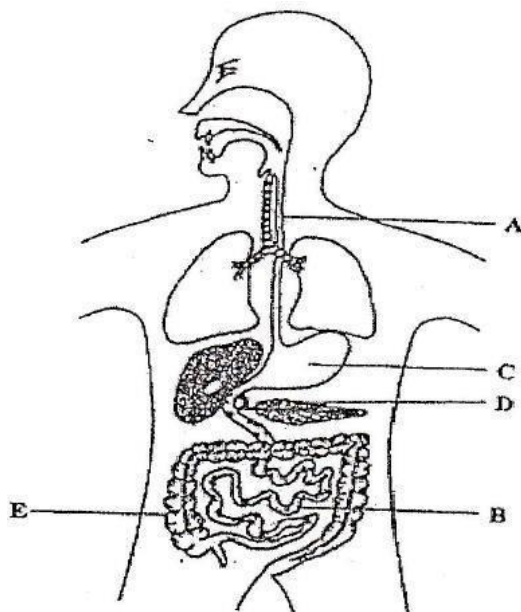
a) Plants are made of cells. The diagram below shows a plant cell. Complete the table and give one function of each part. **(6 marks)**



	Name	Function
A		
B		
C		

b) Animals are made of cells. Describe two differences and similarities between plant and animal cells. **(4 marks)**

16. The diagram below shows several organs of a human body.



Complete the table below by naming each labelled organ and give one of its functions. **(10 marks)**

	Name	Function
A		
B		
C		
D		
E		

17. (a) Define pollination. **(2 marks)**

(b) Explain how the increased use of fossil fuels could be responsible for acid rain and global warming.

Acid rain.....

(4 marks)

Global warming.....

(4 marks)

18. (a) Describe the process of fertilization in man.

(4 marks)

(b) How can you prevent fertilization in man?

(6 marks)

SECTION C: Attempt one question from this section. (15 MARKS)

19. a) Describe the different types of carbohydrates giving examples of each type.

(10 marks)

b) You are provided with a solution which is suspected to contain reducing sugar. Describe the possible tests you can carry out to confirm that it is a reducing sugar. **(6 marks)**

20. a) Describe the composition of blood.

(4 marks) b) Explain how blood cells

transport oxygen. **(4 marks)**

c) How are blood cells adapted to transport oxygen?

(4 marks)

d) Explain why animal cells burst when in water but plant cells do not.

(3 marks)

MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2009

Section A: Answer all questions

1. Characteristics of class Amphibia

- Possess gills as in tadpoles and lungs as in adults for gaseous exchange,
- Exhibit external fertilization
- Have webbed feet,
- Hind limbs longer than fore limbs,
- Poikilothermic i.e. variable temperature of the body,
- Breathe through the skin,
- Moist skin with glands but no scales,

- 3 chambered heart,
- Oviparous i.e. lay eggs in the water, □ Live in both water and on land,
- Undergo metamorphosis.

2.

Structures	Functions
<i>Pancreas</i>	• Produce digestive enzymes • Produce hormones (insulin and glucagon)
<i>Muscles</i>	• Help in locomotion/movement • Help in respiration • Attachment of bones or fix joints • Reserves glycogen • Help in peristalsis • Maintain blood movement in veins and arteries • Maintain body posture and balance □ <i>Contraction of cardiac muscles.</i>
<i>Gills</i>	□ <i>Used for gaseous exchange in aquatic organisms.</i>

3.

Structures	Organisms
<i>Antennae</i>	<i>Housefly</i>
<i>Flagella</i>	<i>Euglena</i>
<i>Spores</i>	<i>Fungus</i>
<i>Coiled shell</i>	<i>Snail</i>

4.

- The cell surface membrane (pseudopodia) flows around and engulfs the food particle.
- Membrane forms a vesicle containing food particle.
- The vesicle (food vacuole) is digested by enzymes and the products of digestion diffuse to the cytoplasm out of food vacuole.
- The waste products are taken to the outside of the cell by exocytosis.

5. a) Have large surface area, thin membrane/walls, moist surfaces, have dense capillary networks for continuous

movement (good transport system, have permeable membrane walls.

b) Aerobic respiration has complete combustion of substrate and produces a lot of energy in form of ATP compared to anaerobic respiration.

There is no formation of lactic acid which causes muscles cramps as is the case in anaerobic respiration

6. (a) Osmosis is the movement of water molecules from a medium of high water potential to a medium lower water potential across a semi-permeable membrane.

b) Because osmosis involves the movement of water molecules only while diffusion involves the movement of all molecules moving down their concentration gradient.

7. i) A: chromosome; B: Centrioles; C: Spindle fibres ii) Anaphase

iii) Growth of cells; Repair / replacement of dead and damaged cells; Asexual reproduction; Growth of organisms.

8. (a) There are no starch digestion enzymes in the stomach. Stomach conditions are acidic and starch digesting enzymes work in alkaline conditions. (b) Every enzyme has its own substrate on which it acts.

9. (a) The blood passes into the heart twice for a complete circuit.

b) Large organisms have more cells

They produce more waste that need to be removed as quickly as possible

They have a small surface area volume ratio to rely on diffusion

They need internal transport system to move substances around the body.

10.(a) In the liver

b) Insulin and glucagon

c) A person with excess glucose suffers from diabetes. (Excess glucose/sugars passes in urine.

11.

Numbers	Name of part
---------	--------------

1	<i>Trachea / Wind pipe</i>
2	<i>Intercostal muscle</i>
3	<i>Bronchiole</i>
4	<i>Diaphragm</i>
5	<i>Alveolus / alveoli / air sac</i>

12.(a) A: incisors, B: Canine, C: Carnassials (premolars/molars)

(b) A: cutting / holding / pulling apart

B: Tearing / killing / holding prey

C: crushing/ cutting/ grinding shearing.

(c) i) Up and down. ii) From side to side

13.(a) bb

(b) BB, Bb

SECTION B: Attempt any THREE questions in this section

14.(a) Photosynthesis is the process by which green plants make their own food by using carbon dioxide and water in presence of sunlight energy and chlorophyll.

(b) Carbon dioxide, water.

(c) Large surface area to absorb light.

Thin and flat to maximize diffusion.

Veins support the leaf/network of veins to bring in water and food.

Air spaces to aid diffusion.

Stomata to allow gas exchange

Mesophyll cells packed with chloroplast

Epidermis that is transparent is transparent to allow light to pass through The cuticle is water proof.

(d) Availability of water, carbon dioxide, chlorophyll and temperature.

15. (a)

	Name	Function
A	Cell wall	For support or to keep cell rigid
B	Nucleus	Controls the cell/organises cell Contains genetic information
C	Cytoplasm	Where chemical reaction take place

(b) Similarities between plant and animal cells: both have a cell membrane, both have a nucleus, both contain a cytoplasm, both carry out respiration

Differences between plant and animal cells

Plant cells	Animal cells
Have cell walls	Have no cell walls
Have a regular shape	Have an irregular shape
Have chloroplasts	Have no chloroplasts
Centrioles absent	Centrioles present

16.

	Name	Function
A	Oesophagus	Connects food from mouth to stomach / takes food to stomach
B	Ileum / small intestine	Site for food absorption
C	Stomach	Stores food temporarily and site for protein digestion
D	Pancreas	Produces enzymes that break down food into smaller particles
E	Colon / Large intestine	Site for water absorption

17.a) **Pollution** is the contamination of Earth's environment with materials that interfere with human health, the quality of life, or the natural functioning of ecosystems (living organisms and their physical surroundings). Although some environmental pollution is a result of natural causes such as volcanic eruptions, most is caused by human activities.

b) **Acid rain:** Gases produced by burning fuel e.g. sulphur dioxide and carbon dioxide, dissolve in water to make a weak acid (carbonic acid).

Global warming: carbon dioxide produced will build up in the atmosphere. The short wave length heat rays from the sun penetrate but longer wave length heat rays are reflected back. The earth heats up.

18.a) There is release of reproductive cells (egg and sperm). They meet and fusion occurs. The zygote formed then gets implanted. The zygote then grows into an embryo.

b) Through use of male or female condoms.

Through abstaining from sexual intercourse.

Through carrying out tubal ligation in females or vasectomy in males.

Through use of a diaphragm that is placed at the cervix.

Through use of spermicides which destroy the sperms.

Through use of combined oral contraceptive pills. Through use of a copper IUD.

SECTION C: Attempt one question from this section.

19.(a) There are three types of carbohydrates

Monosaccharides: These are the smallest of carbohydrates and are the building blocks for other carbohydrates. They are sweet, can crystallise and are highly soluble in water. They include; **glucose, galactose and fructose** as the common hexoses.

Disaccharides: These are formed by combining two monosaccharides in a condensation reaction which involves loss of water. They are also sweet, can crystallise and are highly soluble in water. There are main disaccharides which include the following;

Maltose: Formed by combining two glucose molecules.

Lactose: Formed by combining glucose and galactose

Sucrose: Formed by combining glucose and fructose

Polysaccharides: These are much bigger than the disaccharides. They are insoluble in water and are not sweet. They are bulky and are main storage organs in plants and animals.

They include:

Starch: which is formed from α -glucose. It is found in plants.

Cellulose: composed of β -glucose. Found in animals and fungi.

Glycogen: composed of α -glucose. Found in animals and fungi.

Test for reducing sugars:

Apparatus: Test tubes, heat source, Benedict's solution, solution containing reducing sugars.

Procedure:

Place 2cm³ of a solution containing reducing sugars in a test tube. Add 2cm³ of Benedict's solution and heat for 1 minute.

Observation: The colour of the solution turns from blue to green to yellow and finally brown.

Conclusion: Reducing sugars are present.

20. (a) It is composed of white blood cells, red blood cells, plasma, platelets. (b) It is the red blood cells which transport oxygen. They contain a pigment called haemoglobin which combines with oxygen in the lungs to form a compound called oxyhaemoglobin. In the tissues, oxyhaemoglobin dissociates again forming oxygen and haemoglobin. In this way, oxygen will be transported to the body parts.
- (c) They have a thin membrane to allow easy diffusion of gases.
They have haemoglobin which helps to transport oxygen.
They lack a nucleus which creates enough space for transporting gases.
They are disc shaped to increase the surface area for absorption. They are numerous in number.
- (d) It is because animal cells have a cell membrane but lack a cell wall hence cannot withstand the pressure from the swelling of water. However, plant cells have a cell wall which can prevent the further entry of water thus preventing bursting.



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

BIOLOGY I

002

09 Nov. 2010 08.30 – 11.30 am

ORDINARY LEVEL NATIONAL EXAMINATIONS 2010

SUBJECT: BIOLOGY I

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A, B** and **C**

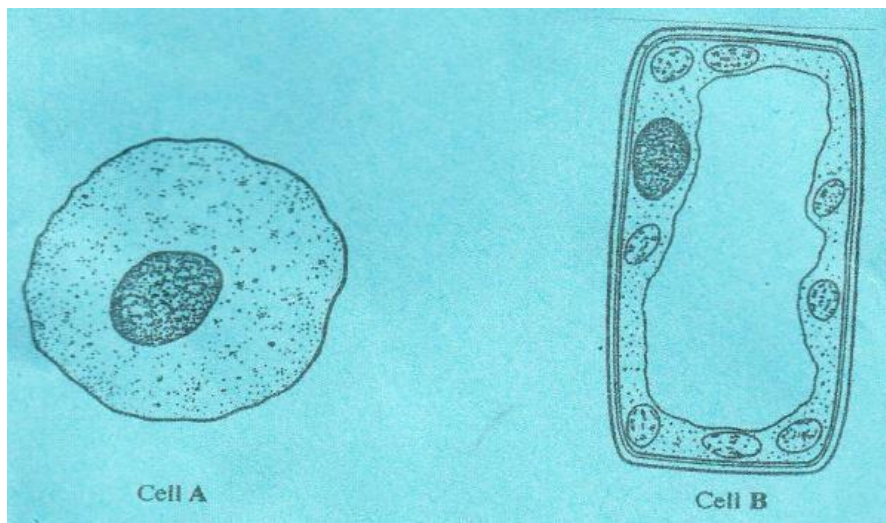
Answer **ALL** questions in section A. **(55 marks)**

Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

SECTION A: ANSWER ALL QUESTIONS (55 MARKS)

1. The diagrams below, are of a plant and an animal cell.



Using the diagrams, answer the following questions: *a)*
Name two structures found only in cell B.

(i) (1 mark)

(ii) (1 mark)

b) Name two structures found in cells A and B.

(i) (1 mark)

(ii) (1 mark)

c) (i) Which diagram shows a plant cell? (1 mark)

(ii) Give a reason for your answer in c (i). (1 mark)

2. *a)* State the region of the leaf which contains most chloroplasts. (2 marks)

b) What biological process occurs in the chloroplasts? (1 mark)

c) Explain the role of air spaces in the leaf. (2 marks)

3. The liver has an important function of maintaining balance in the amounts of nutrients in the blood of humans. It performs this function with the assistance of hormones.

a) Briefly outline how the liver adjusts the amount of proteins and carbohydrates present in the blood. (2 marks)

b) Describe ONE other function of the liver. (1 mark)

4. Proteins help in body building. Starch provides energy.

a) Give one reason for a child's diet being rich in proteins. (1 mark) *b)* Give one reason for the diet of an elderly person requiring proteins.

(1 mark)

c) Would a sugar cane cutter diet require more starch than that of a

School teacher? Give a reason for your answer. (1 mark)

5. A student bought a chocolate bar and carried out several food tests on it. The following result were observed:

Benedict's test: an orange colour.

Biuret test: No colour change.

Iodine test: a blue-black colour.

a) What two types of food are present in the chocolate bar? (2 marks)

b) Using the results given above, give one reason to explain why a

chocolate bar is not balanced meal. **(1 mark)**

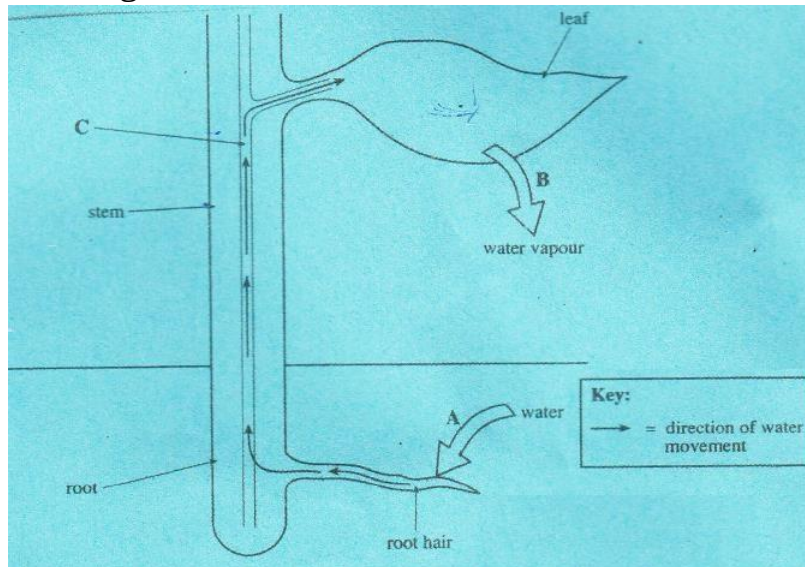
c) Eating this kind of chocolate bar regularly may lead to someone becoming overweight. Explain why. **(2 marks)**

6. a) Where in the digestive system is hydrochloric acid produced? **(1 mark)**

b) What is the function of hydrochloric acid in the digestion of food?

(2 marks)

7. The diagram below shows the movement of water through the plant.



a) Name the Process occurring at: **(2 marks)**

i) A

ii) B

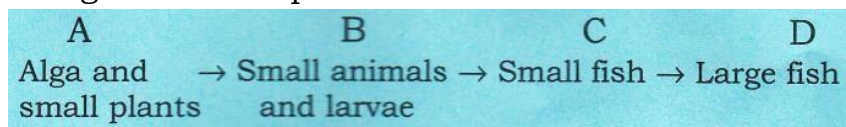
b) Name the tube labelled C. **(1 mark)**

c) State ONE feature of root hairs that helps the process occurring at A.

(1 mark)

d) State TWO functions of water in the plant. **(2 marks)**

8. The figure below represents a food chain in the marine environment.



a) How would you call organisms labelled A and D? **(2 marks)**

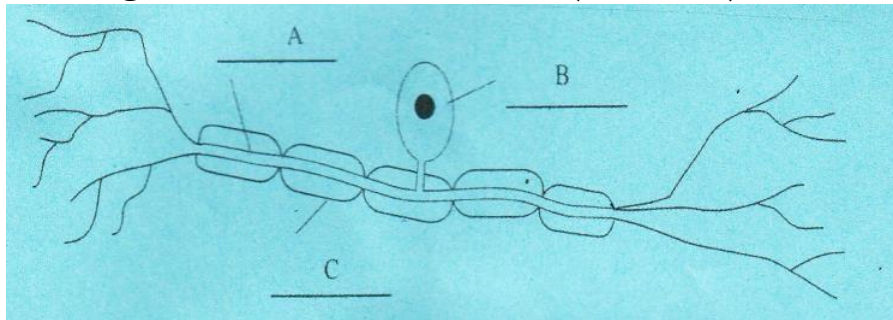
b) Discuss THREE possible effects on this food chain if the small fish at C are removed from it. **(3 marks)**

9. In humans, primordial germ cells undergo a process called Meiosis to produce egg cells and sperm cells. These cells have only half the normal number of chromosomes.

a) What is the name given to a cell with only half the number of chromosomes? **(1 mark)**

b) Sometimes two eggs are fertilized, at the same time, producing non-identical twins. Explain why the offspring from this fertilization will not look exactly alike. **(2 marks)**

10. The diagram below shows a neuron (nerve cell).



a) Name the parts labelled A, B and C. **(3 marks)** A:
B:
C:

b) There are three types of neuron: Sensory, Motor and. Relay. Describe the function of each type of neuron.

Sensory: Motor:

.....

Relay: **(3 marks)**

11. a) How do Plants and animals differ in the way they obtain their food?

(2 marks)

b) Write a balanced chemical equation to represent the process by which plants obtain their food. **(1 mark)**

12. a) What is the essential difference between mitosis and meiosis? **(2 marks)**

b) Predict what is likely to happen to the chromosome numbers in successive generation if zygotic formation occurred from fusion of gametes formed by Mitosis rather than Meiosis? **(1 mark)**

c) The four blood groups found in man are A, B, AB and O. Consider the case of two parents who both belong to blood group A. What will be the possible genotypes and blood groups of their children? **(3 marks)**

Section B: Answer only THREE questions

13. a) Name two foods which are good sources of proteins. **(2 marks)** **b)** Explain briefly why the human body needs proteins. **(2 marks)**

c) Describe an experiment you would carry out to test for proteins in a piece of food. Say what you would expect to see if protein was present.

(3 marks)

d) Human Saliva can change a 1 % starch solution into a Maltose solution. Explain why digestive juice from the human stomach would not have this effect. **(3 marks)**

14. Cholera is a highly dangerous disease which is spread by bacteria. It is spread by eating by drinking food or water which is contaminated with the bacteria.

a) Which parts of the body are likely to be infected first when someone drinks water containing the cholera bacteria? **(1 mark)**

b) Explain how the cholera bacteria inside the body may cause disease.

(2 marks)

c) Name one other group of microbes that frequently cause diseases.

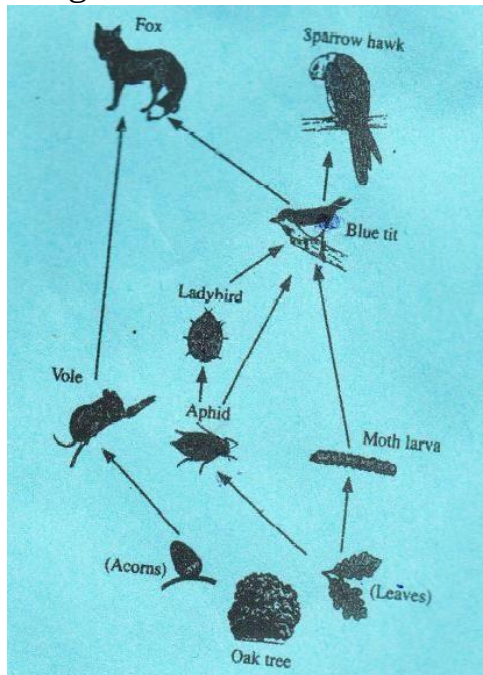
(1 mark)

d) Cholera is very common in refugee camps where people live in crowded rudimentary accommodation. Explain why these people are likely to catch this disease. **(1 mark)**

e) Explain how the body defends itself against bacteria. **(3 marks)**

f) Smoking can cause diseases such as lung cancer. Explain why diseases caused by smoking are not infectious. **(2 marks)**

15. The diagram below shows a woodland food web.



a) Using the information in the food web, construct a food chain in spaces below. The producer has been included for you.

Oak tree leaves → → → → **(2 marks)** **b)**

What do arrows in the food chain indicate? **(1 mark)**

c) Why is the Oak tree called producer? **(1 mark)**

d) From the diagram: **(2 marks)**

(i) Name one herbivore.

(ii) Name one carnivore.

e) List **FOUR** effects that a large increase in the Ladybird population would have on the food web as a whole. **(4 marks)**

16. In Labrador dogs, the hair colour is controlled by a single gene which exists in two forms (alleles): black and yellow. A male dog with black hair is mated with female dog with yellow hair. All the F1 offspring (puppies) have black hair. When the puppies are old enough, two of them are mated together.

a) Complete the key to show the allele for yellow hair.

Key: B = Allele for black hair

..... = Allele for yellow hair

b) Complete the following to show the two matings:

1st mating

Parents: Male x Female

Phenotype: (2 marks) Genotype:

.....

F1

Gametes	.....	.....
.....		
.....		

(2 marks)

2nd mating (F1 Puppy X F1 Puppy)

Gametes	.....	.....
.....		
.....		

(2 marks)

c) If eight puppies were born in the second mating, how many are likely to have yellow hair? (1 mark) d) Using the information given above, state: (2 marks)

- (i) The heterozygous genotype.
- (ii) The dominant allele.

17. a) Define the term "Enzyme". (2 marks)

b) Describe the characteristics of enzymes.

(8 marks)

Section C: Answer only ONE question. (15 marks)

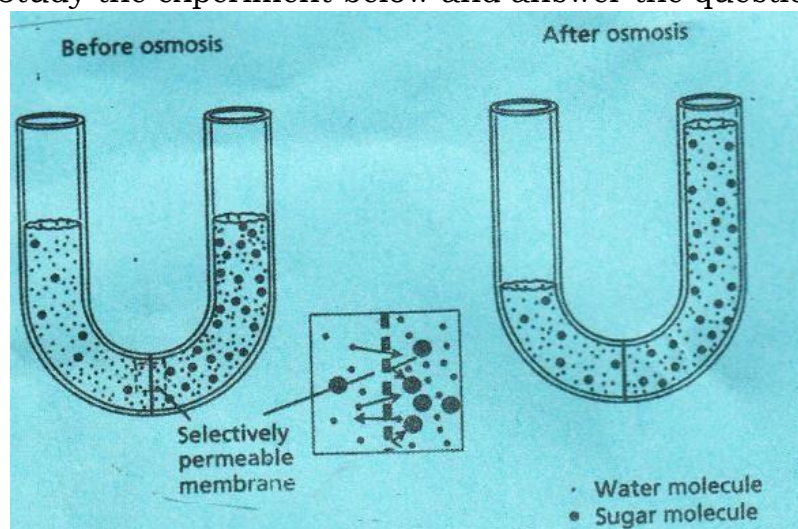
18. a) Define the following biological terms.

(i) Osmosis (2 marks)

(ii) Diffusion (2 marks)

b) Give two processes where Osmosis is used in living things. (2 marks)

c) Study the experiment below and answer the questions that follow.



(i) Why did the number of water molecules on each side of the membrane change, whereas the number of sugar molecules remained the same?

(5 marks)

(ii) How does the plasma membrane of a cell compare with the membrane in the U-shaped tubes? **(4 marks)**

19. Describe an experiment you would carry out to test solutions suspected to contain.

(i) Glucose

(ii) Sucrose

In your description, name the reagents you would use and mention the results you expect.

(15 marks)

MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2010

Section A: Answer all questions

1.

a)

i. Chloroplasts

ii. Cell wall

b)

i. Mitochondria

ii. Nucleus

iii. Ribosomes

iv. ER

c)

i. Cell B

ii. Because it has a cell wall and chloroplasts

2.

i. Palisade mesophyll

ii. Photosynthesis

iii. To allow the gaseous exchange in the leaf

3.

a) The liver adjusts the amount of carbohydrates in the body by using two hormones insulin and glucagon. When the blood glucose level increases, insulin stimulates the conversion of glucose into glycogen and fats. When the blood glucose level decreases below the set point, glucagon stimulates the conversion of glycogen and fats into glucose. There is no hormone involved in the

regulation of proteins. Excess amino acids are deaminated with the formation of ammonia which is converted into urea which is eliminated by the kidney. The remaining part is converted into a carbohydrate.

b) Production of bile, detoxification, storage of blood... 4.

a) A child needs a diet rich in proteins because they are involved in body growth. Proteins are also involved in protecting the child against infections:

antibodies are proteins.

b) An elderly person needs proteins for repair and to replace dead and damaged cells.

c) A sugar cane cutter requires more starch than a school teacher because he uses more energy than a school teacher.

5.

a) Starch and reducing sugars

b) A chocolate bar is not a balanced diet because it does not contain proteins, fats and minerals.

c) Eating this kind of chocolate may make someone to become overweight because it contains sugars. The excess of sugars may be converted to fats by our body leading to increase of body mass.

6.

a) Stomach

b) Hydrochloric acid kills the germs present in the food; it activates the enzyme pepsin; it provides a suitable PH for gastric enzymes.

7.

a)

i. A: absorption of water and mineral salts

ii. B: Transpiration

b) Xylem vessels

c) Root hairs have an elongated shape which increases the surface area for absorption of water and minerals. Root hairs have many mitochondria which provide the energy for the active transport of mineral salts. d)

- Water helps in the transport of substances in the plant.
- Water is a raw material in photosynthesis.
- Water is a medium of chemical reactions.
- Water helps in seed germination.

- *Water helps in pollination...*

8.

a) A: producers or autotrophic organisms; D: tertiary consumers or top carnivores

b) The small plants will die; decrease. small animals and larvae will increase; the alga and

9.

a) Haploid

b) They will not look alike because they do not have the same genetic material / the same DNA. Or they do not have the same genes.

10.

a) A: axon; B: cell body; C: Schwann cell or myelin sheath

b) **Sensory neurons:** carry nerve impulses from sense organs to the CNS.

Motor neurons: carry nerve impulses (commands) from the CNS to the effectors.

Interneurons: make connections between sensory neurons and motor neurons.

11.

a) Plants make their own food by the process of photosynthesis; they are autotrophic. Animals cannot make their own food; they are heterotrophic.

sunlight

b) $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

12. a) Differences between mitosis and meiosis

Mitosis	Meiosis
One diploid cell produces two diploid cells	One diploid cell produces four haploid cells
Daughter cells are genetically identical to the mother cell.	Daughter cells are genetically different to the mother cell.
Involved in sexual reproduction	Involved in growth and asexual reproduction

b) The number of chromosomes would increase at each generation (from $2n$ to $4n$; and from $4n$ to $8n$...)

c) Individuals with blood group A can have two possible genotypes: AA or AO First case: AA x AA

Gametes	A	A
A	AA	AA

A	AA	AA
----------	-----------	-----------

Phenotypes: All children have group A.

Second case: AO x AO

Gametes	A	O
A	AA	AO
O	AO	OO

Phenotypes: 75 % of children have group A; 25 % of children have group O.

SECTION B: ANSWER ONLY THREE QUESTIONS

13.

- a) Meat, fish, milk, eggs
- b) The human body needs proteins for the following reasons:
body growth, production of antibodies, production of hormones, production of enzymes, manufacture of haemoglobin and collagen...
- c) Put 1cm³ of test solution; add 1cm³ of sodium hydroxide, add 3 drops of copper sulphate (it has a blue colour).
Observation: the solution changes **from blue to purple**:
proteins **are present**. The solution remains blue:
proteins are absent.
- d) Human saliva can change a 1 % starch solution into maltose because it contains salivary amylase which can change starch into maltose. The gastric juice would not have this effect because salivary amylase in from the mouth has been inactivated by the hydrochloric acid in the gastric juice.

14.

- a) Small intestines
- b) Cholera bacterium produces a toxin that causes the small intestine to secrete large amounts of fluid, which leads to the fluid loss characteristic of the disease.
- c) Protozoa
- d) People in refugee camps are likely to catch this disease because there is poor sanitation (water may be polluted by bacteria) and poor disposal of wastes.
- e) The body defends itself against bacteria by using different types of white blood cells such as neutrophil which kill bacteria by phagocytosis and lymphocytes which produce antibodies which

kill specifically the bacteria. The body also uses the skin as the first barrier to infections. The secretions produced by the skin and other mucous membranes are able to kill bacteria. Lysozyme produced by tears kill pathogens...

- f) Diseases caused by smoking are not infectious because they are not caused by microorganisms. Infectious diseases are caused by microorganisms and can be transmitted through air, food or water.

15.

- a) Oak tree leaves → Aphid → Ladybird → Blue tit → Fox
Oak tree leaves → Aphid → Ladybird → Blue tit → Sparrow hawk
- b) The arrows indicate 'is eaten by'
- c) The oak tree is called a producer because it makes its own food by photosynthesis.
- d)
- i. Herbivore: moth larva, aphid or vole
 - ii. Carnivore: Fox, sparrow hawk, ladybird or blue tit
- e) The blue tit will increase; the aphids will decrease; the fox will increase; the sparrow hawk will increase.

16.

- a) **B**: allele for black hair

b: allele for yellow hair

- b) First mating

Parents: Male and female

Phenotype: **Black hair x yellow hair**

Genotypes: **BB x bb**

F1

Gametes	B	B
b	Bb	Bb
b	Bb	Bb

2nd mating (F1 puppy X F1 puppy)

F2

Gametes	B	b
B	BB	Bb
b	Bb	bb

- c) 2 have yellow hair; 6 have black hair.

- d)

- i. Heterozygous genotype: Bb
- ii. Dominant allele: black

17.

a) Enzymes are proteins that catalyze (i.e., increase the rates of) biochemical reactions. In enzymatic reactions, the molecules at the beginning of the process, called **substrates**, are converted into different molecules, called **products**.

b) Characteristics of enzymes:

- **Enzymes are not destroyed by the reaction** they catalyze and so can be used again.
- **An enzyme can work in either direction.** Metabolic reactions are reversible and the direction in which they proceed depends on the relative amounts of substrate and products present. The reaction will proceed from left to right until equilibrium between substrate and products is reached
- **Enzymes are inactivated by excessive heat.** This property of enzymes relates to the fact that they are proteins. The proteins (and therefore enzymes) are denatured at high temperatures. Few cells can tolerate temperatures higher than approximately 45°C.
- **Enzymes are sensitive to PH.** Every enzyme has its own range of PH in which it functions most efficiently. Most intracellular enzymes function best at or around neutral. Excessive acidity or alkalinity renders them inactive.
- **Enzymes are specific** in the reaction they catalyze, much more than inorganic catalysts. Normally, a given enzyme will catalyze only one reaction or type of reaction. However, the degree of specificity varies from one enzyme to another.
- **Enzymes lower the activation energy of reactions they catalyze.** The activation energy is the energy necessary for a reaction to get started.
- **Enzymes possess active sites where the reaction takes place.** These sites have specific shapes.
- **All enzymes are globular proteins.**

SECTION C: ANSWER ONLY ONE QUESTION

18.

a)

- i. Osmosis is the movement of water molecules from hypotonic solution to hypertonic solution through a selectively permeable membrane. Or osmosis is the movement of water molecules from a medium of high water potential to a medium of low water potential to through a semi / selectively permeable membrane.
- ii. Diffusion is the movement of molecules from a medium of high concentration to a medium of low concentration.
- b) Absorption of water by root hairs; loss of water in gaseous state through stomata (transpiration); guttation; seed germination
- c)
 - i. The number of water molecules changes on each side of the membrane because water molecules are able to pass through the selectively permeable membrane. The number of sugar molecules does not change on each side of the membrane because sugar molecules are too big to pass through the selectively permeable membrane.
 - ii. The plasma membrane of a cell compares with the membrane in the U- shaped tubes because they are all selectively permeable (they allow certain molecules to pass through while preventing others from passing through).

19.

i. Test of glucose

- Put 1cm^3 of test solution suspected to contain glucose in a test tube
- Add 1cm^3 of **Benedict's solution**
- Boil
- **Observation:** the colour changes from blue, green, yellow, orange and finally red brown precipitate; glucose is present or any other reducing sugar is present. The colour remains blue, glucose or any other reducing sugar is absent.

ii. Test of sucrose

- Put 1cm^3 of test solution suspected to contain sucrose
- Add 1cm^3 of **Benedict's solution**
- Boil
- The colour remains blue. This means that there is no glucose or any other reducing sugar.

- Put 1cm³ of test solution suspected to contain sucrose
- Add 1 cm³ of **hydrochloric acid** and **boil**
- Add 1 cm³ of **sodium hydroxide** followed by 1cm³ of **Benedict's solution** and boil again.
- **Observation:** the colour changes from blue, green, yellow, orange and finally red brown precipitate; sucrose is present or any other non-reducing sugar is present. The colour remains blue, sucrose or any other non-reducing sugar is absent.

BIOLOGY I

001

07 Nov. 2011 08.30 am – 11.30 am

REPUBLIC OF RWANDA



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

ORDINARY LEVEL NATIONAL EXAMINATIONS 2011

SUBJECT: BIOLOGY I

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A**, **B** and **C**

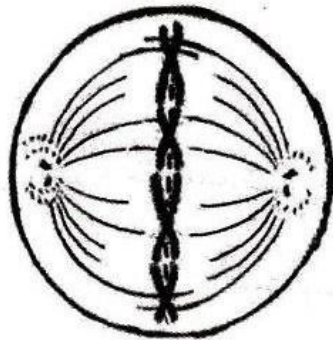
Answer **ALL** questions in section A. **(55 marks)**

Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

SECTION A: Attempt all questions from this section. (55 marks)

1. (a) Name any two diseases caused by a virus. **(2 marks)**
(b) A virus is described as a living and non-living organism. Explain why. **(2 marks)**
2. The following are parts of an organism: cell, organ, gene, tissue, chromosome, system. Arrange them in an increasing order of their size (i.e. from the smallest to the largest). **(6 marks)**
3. (a) What is the function of each of the following cell organelle?
(i) Mitochondrion. **(1 mark)**
(ii) Chloroplasts. **(1 mark)**
(iii) Golgi apparatus. **(1 mark)**
(iv) Endoplasmic reticulum. **(1 mark)**
(b) Give at least two similarities between an animal and a plant cell. **(2 marks)**
4. The figure below shows one of the stages of mitosis of cell division.



- (a) Which stage is represented in the figure? **(1 mark)**
(b) Describe the behaviour of chromosomes in this stage. **(2 marks)**
5. (a) Name different blood groups. **(2 marks)**
(b) What are the blood groups of:
(i) Universal donor? **(1 mark)**
(ii) Universal recipient? **(1 mark)**
6. (a) What are functions of the stomach in the digestion of man? **(2 marks)**

(b) Explain why carbohydrates are not digested in the stomach. **(2 marks)**

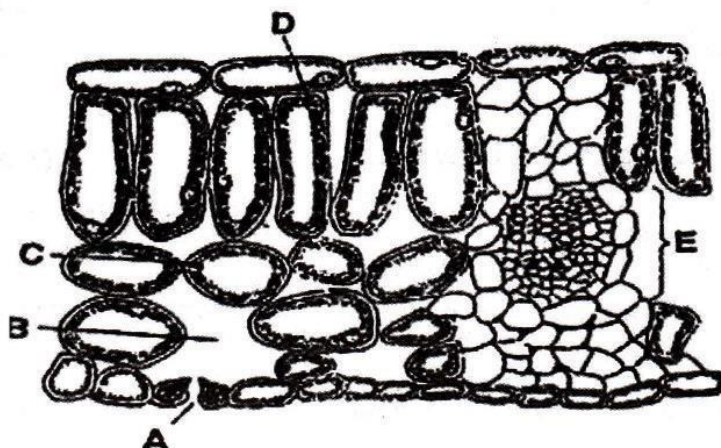
7. (a) Describe blood functions in a mammal. **(3 marks)**

(b) Give ONE reason why blood in arteries has high pressure than in veins. **(1 mark)**

8. (a) What features (adaptations) of fish enable it to live in water? **(2 marks)**

(b) Why does fish die immediately it is removed from water? **(2 marks)**

9. The figure below shows a cross section of a green leaf.



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

(b) What is the function of structures A and D respectively? **(2 marks)**

10. Explain the following biological statements.

(a) Green plants manufacture their own food. **(1 mark)** (b) Animals are heterotrophic organisms. **(1 mark)**

(c) There is no photosynthesis in plant roots. **(2 marks)**

11. The chromosomes for determining the human sex are labelled X and Y.

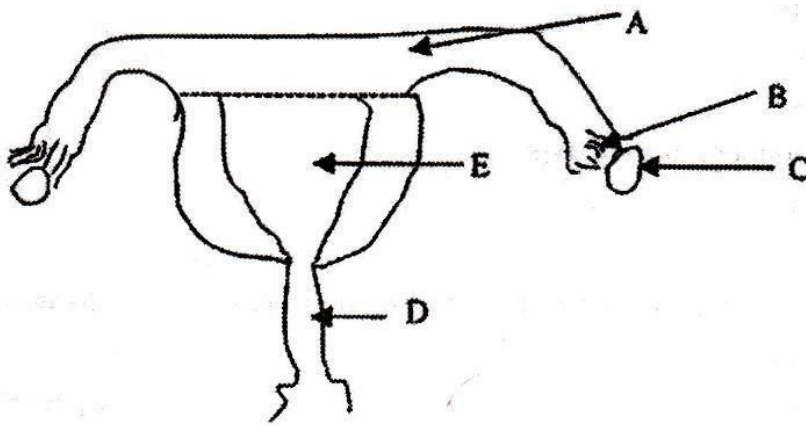
		Parent 1	
		X	X
Parent 2	X		
	...		...

(a) Complete the punnett square to show the genotype of (i) Parent 2

(ii) Of four offspring **(5 marks)** (b) Which parent is the mother? **(1 mark)**

(c) What are chances of getting a baby girl? **(1 mark)**

12. Examine the figure below and answer the questions that follow.



(a) What does this figure represent? **(0.5 mark)**

(b) Name the parts labelled A, B, C, D and E. **(2.5 marks)** **SECTION B:**
Attempt any THREE questions only. (30 marks)

13. The government of Rwanda has set up several organizations to fight against AIDS.

(a) What is AIDS in full? **(1 mark)** (b) What causes AIDS? **(1 mark)**

(c) How is AIDS spread from one person to another? **(3 marks)**

(d) Suggest at least five possible methods which you can use to prevent the spread of AIDS. **(5 marks)**

14. The following organisms were found abandoned in AKAGERA. National Park in Rwanda:

- Green plants
- Hawks
- Lizards
- Grasshoppers and locusts - Snakes.

(a) Construct the food chain to show their feeding relations. **(4 marks)** (b) Which organisms are:

(i) Herbivores? **(1 mark)**

(ii) Tertiary consumers? **(1 mark)**

(iii) Top carnivores? **(1 mark)** (iv) Producers? **(1 mark)**

(c) What effect would the removal of grasshoppers and locusts have on other organisms? **(2 marks)**

15. (a) Draw a well labelled diagram of an external structure of a green plant leaf. **(5 marks)**

(b) One of the functions of a leaf is to carry out photosynthesis. How is a leaf adapted for this function? **(5 marks)**

16. (a) Define the term Photosynthesis. **(2 marks)**

(b) What are necessary conditions for photosynthesis to take place? **(4 marks)**

(c) What factors may affect the rate of photosynthesis? **(4 marks)**

- 17.** (a) What are functions of the stomach in the digestion of man?
Define the term "Digestion". **(1 mark)** (b) Name any three protein
digesting enzymes. **(3 marks)**
(c) Mention any six healthy nutritional habits we are advised to practice.
(6 marks)

SECTION C: Attempt only ONE question. (15 marks)

- 18.** The government of Rwanda has established a parastatal body called RWANDA ENVIRONMENTAL MANAGEMENT AUTHORITY (REMA) to fight against the destruction of our environment.
(a) In what ways is our environment being destroyed? **(5 marks)**
(b) Suggest all possible ways it has put forward to conserve our environment.
(10 marks)
- 19.** (a) (i) Define the term Osmosis. **(3 marks)**
(ii) Explain why osmosis is considered as a special case of diffusion.
(2 marks)
(b) Senior three students in a Secondary School in Rwanda carried out an experiment to demonstrate (show) the process of osmosis.
(i) Suggest possible apparatus and substances (chemicals) they are likely to have used. **(3 marks)**
(ii) What observations are they likely to have noticed at the end of the experiment?
(4 marks)
(iii) Explain these observations. **(2 marks)**

MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2011

Section A: Answer all questions

1.

a) AIDS, hepatitis, ebola, influenza, coronavirus...

b) A virus is described as a living thing because it can reproduce inside a host cell and it has a genetic material which may be DNA or RNA. A virus is described as a non-living thing because it cannot grow, it cannot move, it is not made of cells and cannot reproduce on its own.

2. Gene, chromosome, cell, tissue, organ, system.

3.

a)

i. **Mitochondria:** production of energy in the form of ATP or cellular respiration.

ii. **Chloroplasts:** involved in photosynthesis.

iii. **Golgi apparatus:** secretion of cell products, production of lysosomes, maturation of proteins.

iv. **ER:** transport of substances in the cell, protein synthesis, detoxification, lipid synthesis.

b) Differences between animal cells and plant cells

Animal cells	Plant cells
Chloroplasts absent	Chloroplasts present
Cell wall absent	Cell wall present
Centrioles present	Centrioles absent
Irregular shape	Regular shape
Small vacuole or absent	Large vacuole

4.

a) Metaphase

b) Chromosomes are arranged in the middle of the cell. Each chromosome consists of two identical sister chromatids.

5.

a) A, B, AB and O.

b)

i. Universal donor: group O

ii. Universal recipient: group AB

6. a) The stomach performs two main functions: mechanical digestion by its contractions and chemical digestion by pepsin which digests proteins into small

peptides. The stomach secretes the gastric juice which contains hydrochloric acid. Hydrochloric acid kills bacteria and activates the enzyme pepsin.

b) There is no digestion of carbohydrates in the stomach because the stomach does not produce enzymes to digest them. The salivary amylase from the mouth is inactivated by the acid in the stomach.

7. a) The blood performs numerous functions such as: transport of substances in the body, temperature regulation, body defence, transport of oxygen... b) The blood in arteries has a high pressure because arteries carry blood from the heart. Arteries have a thick layer of smooth muscle to withstand this high pressure.

8. a) Fishes have the following adaptations: presence of gills, presence of a swim bladder, and presence of fins.

b) Because gills are not adapted to make gaseous exchange in air. The gills will be damaged in air.

9. a) A: stoma; B: air space in the spongy mesophyll; C: spongy mesophyll cell; D: palisade mesophyll cell; E: vascular tissues.

b) A: allows carbon dioxide to enter into the leaf and oxygen to leave during the day. Or it allows gaseous exchange to take place in the leaf. D: it is where most photosynthesis takes place in the leaf.

10. a) Green plants are able to produce their own food through a process called photosynthesis. They do so by using water and carbon dioxide in presence of sunlight and chlorophyll.

b) Animals are heterotrophic organisms because they cannot make their own food. They need to eat autotrophic organisms producers or others animals. c) There is no photosynthesis in the roots because the roots do not contain chloroplasts, organelles which perform the process of photosynthesis.

11.

		Parent 1	
		X	X
Parent 2	X	XX	XX
	Y	XY	XY

a)

- i. Genotype of parent 2: XY
- ii. Genotypes of the four offspring: table above

b) Parent 1

c) 50 %

12.

- i. Female reproductive system
- ii. A: Oviducts; B: Fimbriae; C: ovary; D: vagina; E: uterus

SECTION B: ANSWER ONLY THREE QUESTIONS

13.

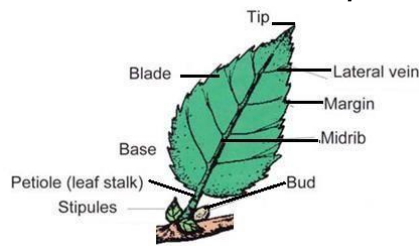
- a) AIDS: Acquired Immune Deficiency Syndrome
- b) HIV virus
- c) Through sex; from mother to child (during childbirth or during breastfeeding) and through sharing cutting items.
- d) Abstinence; being faithful to one non-contaminated partner; using condoms; avoid sharing cutting items; sensitize the population about the transmission of HIV; HIV positive mothers should not breastfeed their children...

14.

- a) Green plants → Grasshoppers and locusts → Lizards → Snakes → Hawks
- b)
 - i. Herbivores: grasshoppers and locusts
 - ii. Tertiary consumers: snakes
 - iii. Top carnivores: hawks
 - iv. Producers: Green plants

c) *The plants will increase. Lizards, snakes and hawks will die*
15.

a) *External structure of the leaf*



b) *Adaptations of the leaf for photosynthesis*

- *A large surface area that collects as much sunlight as possible.*
- *A thin lamina (leaf blade), as most light is absorbed in the first few millimetres of the leaf and the diffusion distance is kept short.*
- *A transparent cuticle and epidermis that let light through to the photosynthetic palisade cells beneath.*
- *Numerous stomata for gaseous exchange that open and close in response to changes in light intensity.*
- *Many air spaces, especially in the spongy mesophyll, to allow diffusion of carbon dioxide and water.*
- *A network of vascular tissue made up of xylem that brings water to the leaf cells and phloem that carries away the sugars produced in photosynthesis.*

16.

a) *Photosynthesis is a metabolic process by which plants and other autotrophic organisms make their own food using water and carbon dioxide in presence of sunlight and chlorophyll.*

b) *Conditions necessary for photosynthesis: presence of water, carbon dioxide, suitable temperature, presence of chlorophyll or chloroplasts.*

c) *Factors that may affect the rate of photosynthesis: water, carbon dioxide, temperature, sunlight and chlorophyll.*

17.

a) *Digestion is the breakdown of food substances in the body in a form that can be absorbed into the bloodstream.*

b)Pepsin: digests proteins into small peptides; **trypsin:** digests proteins into small peptides; **chymotrypsin:** digests proteins into small peptides. c)

- i. Eating high fiber foods which add bulk to the diet, making you feel full faster. Fibers are found in fruits, vegetables, nuts, seeds, bran and barley. They speed up the movement of food through the intestines and stomach, adding bulk to the stool.
- ii. Eating small and regular meals throughout the day. This make food move smoothly through the digestive tract.
- iii. Drinking adequate water as it plays a very important role in the process of digestion.
- iv. Regular exercise can keep food moving smoothly through the digestive system.
- v. Avoiding caffeinated and carbonated drinks, too much spice, dairy products (if lactose intolerant), alcohol and smoking.
- vi. Chewing the food properly in enough time
- vii. Eating a balanced a diet.

SECTION C: ANSWER ONLY ONE QUESTION

18.

a) Our environment is being destroyed in the following ways:

- Deforestation
- Poaching
- Bush burning
- Release of gases by industries
- Soil erosion

- Water pollution
- Use of pesticides such as DDT

b) Possible ways to conserve our environment

- Reforestation

- *Afforestation*
- *Protection of national parks and game reserves*
- *Soil conservation*
- *Protection against pollution and Global warming*
- *Protection of endangered species (Gorillas, Crocodiles, Orchids...)*
- *Avoid using non-biodegradable pesticides in agriculture.*
- g) *Recycling of non-biodegradable substances.*
- *Use of renewable energy sources.*
- *Avoid releasing wastes in water bodies*
- *Preventing soil erosion*
- *Decreasing greenhouse gases released by industries*

19.

a)

- i. *Osmosishypertonic solution through is the movement of water a selectively permeable membrane. Or molecules from hypotonic solution to*

osmosis is the movement of water molecules from a medium of high water potential to a medium of low water potential to through a semi / selectively permeable membrane.

- ii. *Osmosis is a special case of diffusion because osmosis is the movement of water molecules only while diffusion is the movement of all molecules form high concentration to low concentration (water also involved).*
- b)
 - i. *Water, glucose (or salt), U-shaped tubing or a dialysis tubing, beaker*
 - ii. *The level of water in the medium with low water potential increases / rises.*
 - iii. *This is because water always moves from a hypotonic solution to hypertonic solution through a selectively permeable membrane.*

BIOLOGY I

001

21st Nov. 2012 08.30 am – 11.30 am

REPUBLIC OF RWANDA



RWANDA EDUCATION BOARD (REB)
P.O.BOX 3817 KIGALI

ORDINARY LEVEL NATIONAL EXAMINATIONS 2012

SUBJECT: BIOLOGY I

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A**, **B** and **C**

Answer **ALL** questions in section A. **(55 marks)**

Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

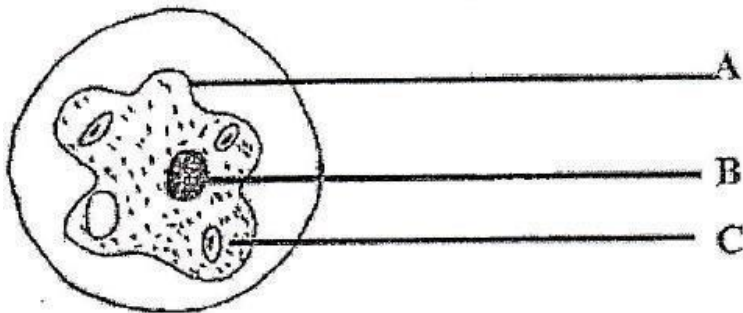
SECTION A: Attempt all questions from this section. (55 marks)

1. Movement is a life process. Name FOUR other life processes that all plants and animals do. **(4 marks)**

i)
 ii) iii)

 iv)

2. Amoeba are single celled animals. The diagram below was drawn by students after observing the amoeba under a microscope.



- a) Name the parts labelled A, B and C. **(3 marks)** A:

B:

C:

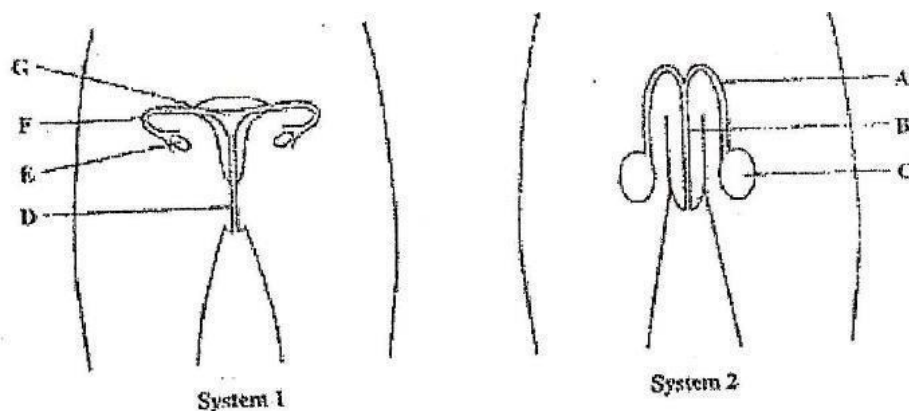
- b) Draw lines to link each part of the amoeba cell with its function.

(3 marks)

PART	FUNCTION
A	Where chemical reactions take place
B	Allows substances to move in and out of the cell
C	controls the characteristics of the cell

- c) In which of these parts of amoeba would you find genes? **(1 mark)**

3. (a) The diagrams below show the reproductive systems in humans.



i) Which is the female reproductive system? **(1 mark)** ii) Use the information in the diagram to complete the table below.

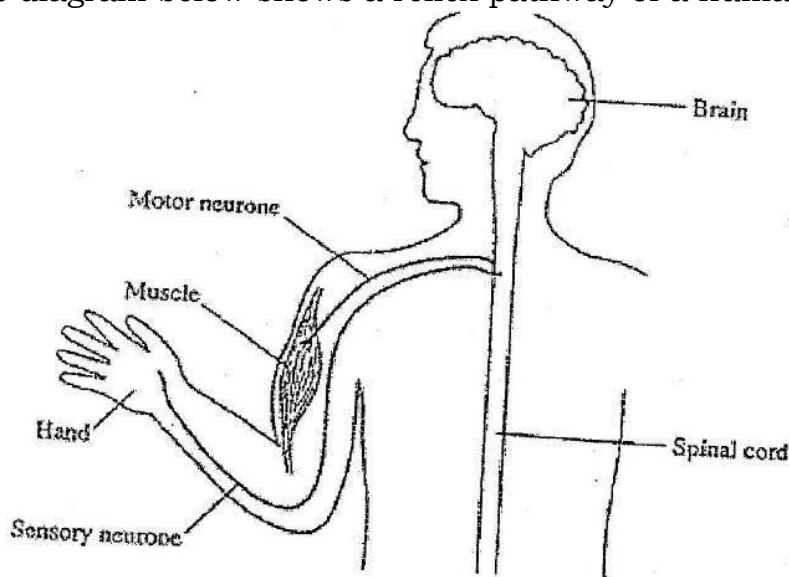
(3 marks)

	Letter
The place where female gametes are formed	
The place where the foetus develops	
The place where male gametes are formed	

b) Give the name of the:

i) Female gamete **(1 mark)** ii) Male gamete **(1 mark)** iii) Process when the male and female gametes fuse together. **(1 mark)**

4. The diagram below shows a reflex pathway of a human.



Draw this diagram and answer the following questions.

- Label the receptor on the diagram. **(1 mark)**
- Label the effector on the diagram. **(1 mark)**
- suggest a stimulus to the hand that could start a reflex response. **(1 mark)**
 - Describe the response this stimulus would cause. **(1 mark)**

d) Put arrows on the diagram to show the direction of the path taken by the nerve impulses. **(1 mark)**

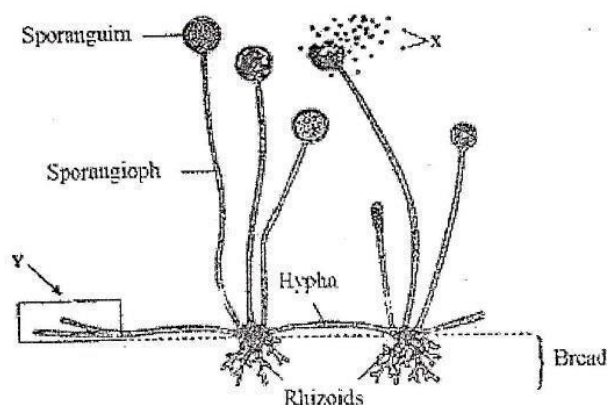
5. (a) Name two things that happen to the glucose produced in plants during photosynthesis. **(2 marks)**

(b) Plants need mineral salts.

i) Through which part do mineral salts get into the plant? **(1 mark)**

ii) Explain why water is important in this process. **(2 marks)**

6. The diagram below shows the structure of a fungi growing on some bread.



a) Give the name of the structure labelled X. **(1 mark)**

b) When the fungus is feeding, the tip of the hyphae labelled Y release enzymes. Explain why? **(2 marks)**

7. Describe the difference between each of the following pairs of biological terms.

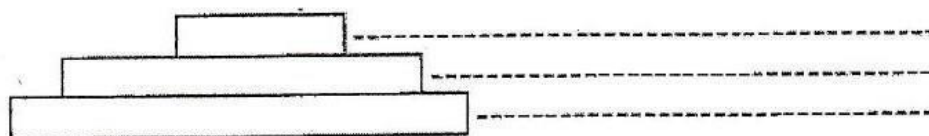
i) Ureter and urethra **(2 marks)** **ii)** Motor neuron and sensory neuron. **(2 marks)**

8. a) Name at least one disease which is spread by houseflies. **(1 mark)** **b)** Explain how house flies can spread diseases. **(4 marks)**

c) Give one way by which we can lower the chances of disease being spread by houseflies, apart from killing the flies. **(1 mark)**

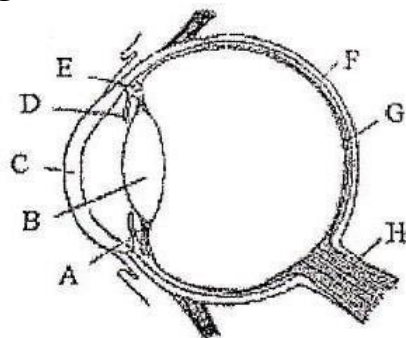
9. The diagram below shows a pyramid of energy for the following food chain.

Grass → cow → man



- a) Write the names of the organisms in the food chain on the correct lines next on the diagram. **(1 mark)**
- b) Where does the grass get its energy from? **(1 mark)**
- c) Explain why energy decreases from one trophic level to the next. **(1 mark)**

10. The diagram shows a section through the human eye.



- a) Label the parts A, B and C. **(3 marks)** A:
B:
C:
- b) Give the letter of the part which;
i) Changes shape to help focus light rays. **(1 mark)** ii) Adjust the amount of light entering the eye. **(1 mark)**

11. Sickle cell anaemia is caused by a change in the gene which controls haemoglobin production. Allele

H: represents the unaffected allele of the haemoglobin gene h:

represents the changed allele of the haemoglobin gene.

There are three possible genotypes:

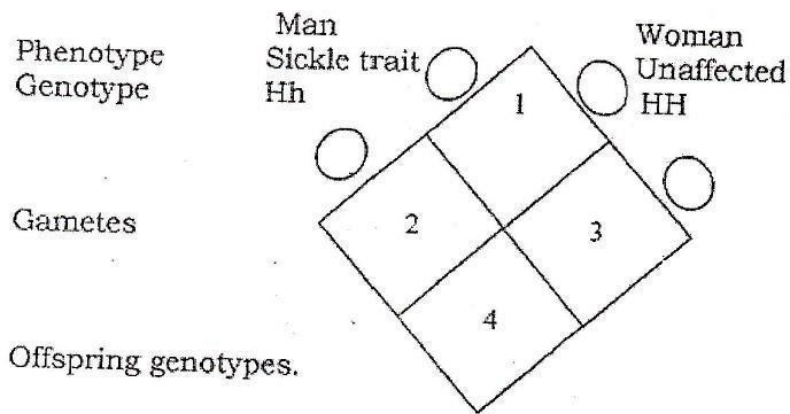
HH: the person who is completely

unaffected Hh: the person is a carrier (sickle

trait) hh: the person who has sickle cell

anaemia.

- a) Complete the genetic diagram below to the production of children by a man with sickle cell anaemia and a woman is completely unaffected by sickle cell condition.



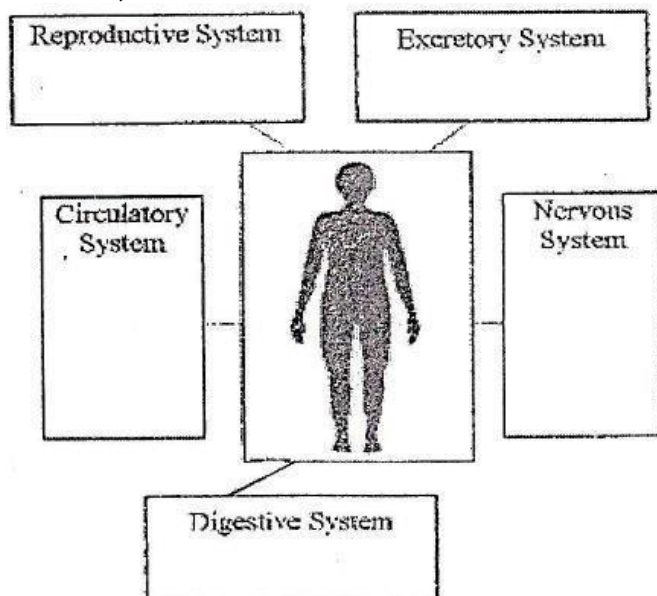
Off spring phenotypes:

- 1.....
- 2.....
- 3.....
- 4.....

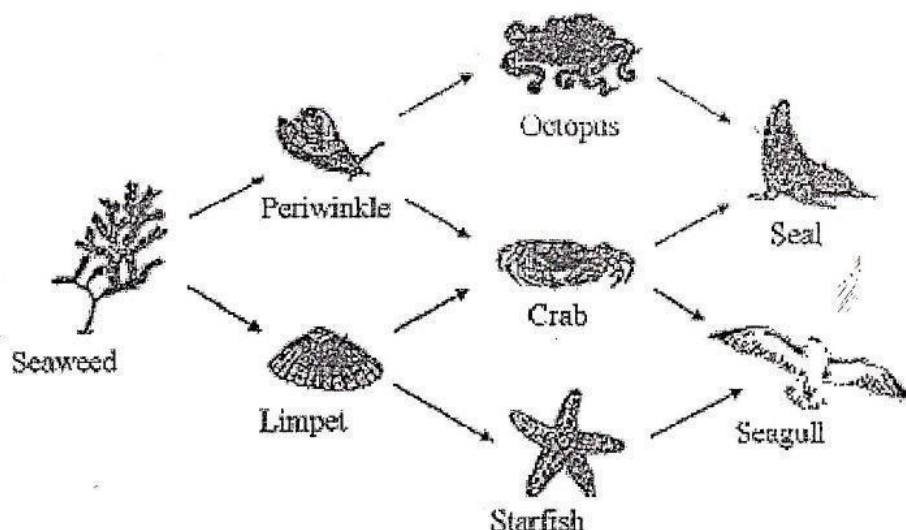
(4 marks) b) Give a reason why it is impossible for this man and woman to produce any children with sickle cell anaemia. **(1 mark)**

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

- 12.** Put each part of the body listed below into a box to show which organ system it is in. **(10 marks)**
Bladder, brain, capillary, heart, kidney, large intestines, ovary, spinal cord, stomach, testis.



- 13.** (a) The diagram below shows part of a food web



Use the organisms in this web to fill in the table.

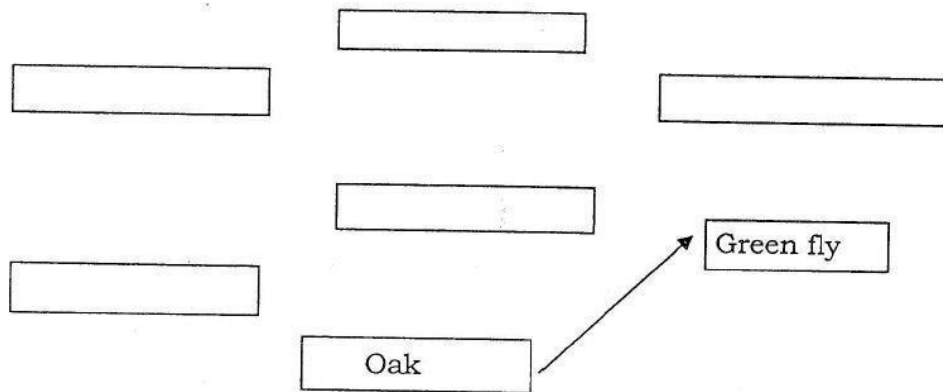
(5 marks)

FEEDING HABIT	ONE ORGANISM
Herbivore	
Producer	
Secondary consumer	
Top carnivore	
Primary consumer	

(b) Some students made the following notes below about feeding relationships in a wood.

- A green fly got its food from an oak tree leaf
- A lady bird ate the green fly
- Moth larva also ate parts of the oak tree.
- Spider ate a lady bird.
- The wood pecker ate the moth larva and the spider.
- A blue tit ate the moth larva and green fly.

Complete the food web to show these relationships. One relationship is already done for you. **(5 marks)**



14. Plants absorb water and dissolved mineral salts from the soil.

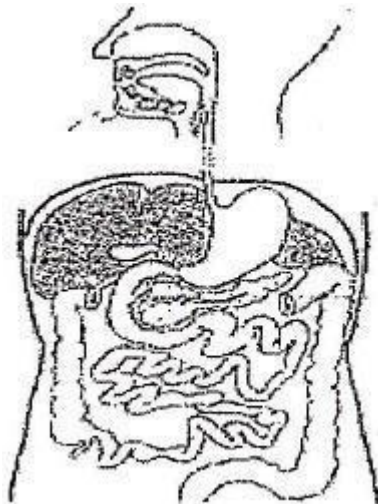
- a)** What do plants make from the following minerals?
 - i)** Magnesium **(1 mark)** **ii)** Nitrates **(1 mark)**
- b)** Give two reasons why water is important for plants. **(2 marks)**
- c)** Which plant vessels transport water and sugar? **(2 marks)**
- d)** Explain how water rises up the plant. **(4 marks)**

15. Malaria is the most killer disease in Africa.

- a)** What causes malaria? **(1 mark)**
- b)** How does it infect people? **(1 mark)**
- c)** Describe all possible means you can recommend to prevent this killer disease. **(8 marks)**

SECTION C: This question is compulsory. (15 marks)

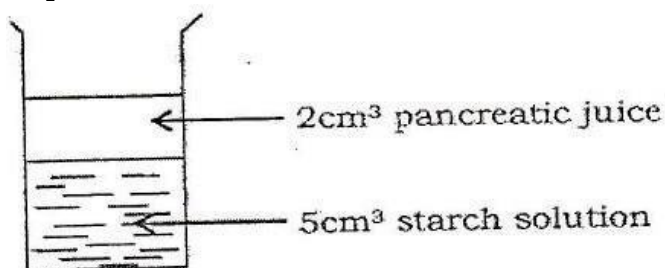
16. The diagram below shows the human alimentary canal.



Draw part of this diagram and answer the question that follows

a) On the diagram, label the salivary glands and the pancreas. **(2 marks)**

b) A mixture of starch and pancreatic juice as shown on the diagram below was kept at 37°C.



Pancreatic juice contains enzymes.

i) Samples were taken from the mixture after one minute and after samples were tested for sugar and starch. The table below shows which test proved positive and which were negative. **(3 marks)**

	Sample 1 (1 minute)	Sample 2 (10 minutes)
Starch test	Positive	Negative
Sugar test	Negative	Positive

Explain what causes these changes in the mixture.

ii) The experiment was repeated using pancreatic juice which had been kept at 100°C for 10 minutes and cooled to room temperature before being added to the starch. Complete the table below to show whether you would expect each test to be positive or negative in the 10 minute samples.

(2 m

arks)

	Sample 1 (1 minute)	Sample 2 (10 minutes)
Starch test	Positive	.....
Sugar test	Negative	.....

iii) How would you test for sugar? What would you observe if sugar was present? **(3 marks)**

c) The sugar produced during digestion is absorbed from the alimentary canal through the villi.

i. Where in the alimentary canal is the villi found? **(1 mark)** ii. State three features of the villi which help it to absorb sugar quickly.

(3 m

arks) **iii.** Name one process by which sugars pass from the inside of the

alimentary canal into the blood stream.

(1 mark)

MARKING OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2012

Section A: Answer all questions

1.

- i. *Reproduction*
- ii. *Growth*
- iii. *Respiration* iv. *Excretion*
- v. *Sensitivity*
- vi. *Feeding*

2.

- a) A: cell membrane; B: nucleus; C: cytoplasm
- b) C: where chemical reactions take place; B: controls the characteristics of the cell; A: allows substances to move in and out of the cell.
- c) In the nucleus (B).

3.

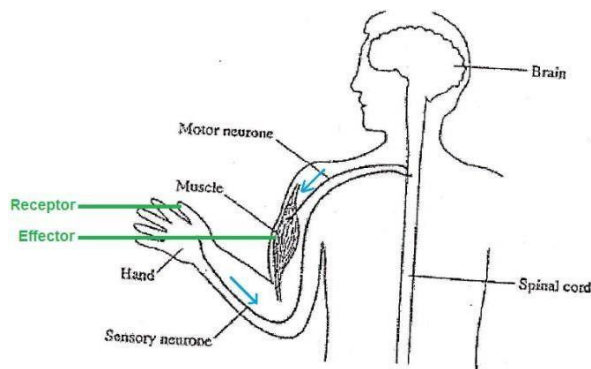
- a)
 - i. *System 1*
 - ii.

	Letter
<i>The place where female gametes are formed</i>	<i>E (ovary)</i>
<i>The place where the foetus develops</i>	<i>G (uterus)</i>
<i>The place where male gametes are formed</i>	<i>C (testis)</i>

4. b)

a) *See the diagram*

- i. *Egg*
- ii. *Sperm*
- iii. *Fertilization*



b) See the diagram

c)

- i. Heat (touching a hot object) using the hand or pricking on a pin
- ii. Removal of the hand

d) See the diagram

5.

a) It may be converted to sucrose to be transported to storage organs where it is again converted into starch. It may also be used in cellular respiration to produce energy required in different metabolic activities. b)

- i. Roots
- ii. Minerals are dissolved in water. Water helps in their transport.

6.

a) Spores

b) The tip of the hypha releases enzymes because fungi use extracellular digestion. In this process, fungi release enzymes on their substrate; the enzymes break down the organic matter into simple monomers which are absorbed by the fungus.

7.

a) The ureter carries urine from the kidney to the bladder while the urethra carries urine from the bladder to the outside.

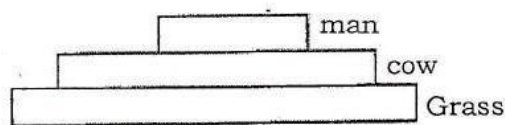
b) The motor neuron carries nerve impulses from the central nervous system to the effectors while the sensory neuron carries nerve impulses from sense organs to the central nervous system.

8.

- a) Cholera, typhoid
- b) Houseflies spread diseases by touching contaminated surfaces and when they meet with food or other utensils that human use, they may be contaminated with microbes which can cause diseases.
- c) Covering food and other utensils that we use in our homes, proper disposal of wastes to avoid their contact with houseflies.

9.

a)



- b) From sunlight
- c) Because energy is lost in different activities such as movement, respiration, temperature regulation from one trophic level to the next

10.

a) A: suspensory ligament; B: lens; C: cornea.

b)

- i. B
- ii. D

11.

a) The man has sickle cell trait (Hh) The man unaffected (HH)

Gametes		Woman	
		H	H
Man	H	HH (1)	HH (2)
	h	Hh (3)	Hh (4)

Offspring genotypes:

1: HH

2: HH

Offspring phenotype

s:

1: completely unaffected

2: completely unaffected

3: carrier

(has sickle cell trait)

3: Hh

4: Hh

4: carrier
(has sickle cell trait)

b) To produce a child with sickle cell anaemia there must be a recessive allele from both parents. The woman has two dominant alleles (normal); so it is impossible.

SECTION B: ANSWER ONLY THREE QUESTIONS

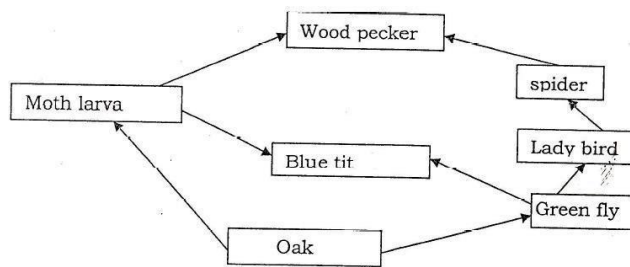
12. Reproductive system: ovary, testis
Circulatory system: capillary, heart
Excretory system: bladder, kidney
Nervous system: brain, spinal cord
Digestive system: large intestine, stomach

13.

a)

FEEDING HABIT	ONE ORGANISM
Herbivore	Limpet or periwinkle
Producer	Sea weed
Secondary consumer	Starfish or crab or octopus
Top carnivore	Seagull
Primary consumer	Limpet or periwinkle

b)



14.

a)

i. Chlorophyll

ii. Protein or amino acids

b) For photosynthesis, hydrolysis, support / turgidity, a medium of chemical reactions, temperature regulation, seed germination, transport of substances

c) Xylem and phloem

d) Transpiration, root pressure, capillary action, cohesion and adhesion of water molecules, osmosis

15.

a) Differences between sexual and asexual reproduction

Asexual reproduction	Sexual reproduction
One parent only	Usually two parents
No gametes are produced	Gametes are produced.
Depends on mitosis	Depends on meiosis
Offspring identical to parent	Offspring are not identical to parents. They show genetic variation
Often results in rapid production of large numbers of offspring	Less rapid increase in numbers

b) Advantages of sexual reproduction: resistance to disease, new varieties produced.

Asexual reproduction: one parent required, very fast, maintenance of useful characters in population

16.

a) Plasmodium.

b) Female anopheles mosquito containing parasites in its blood stream develop. c)

- Clear the mosquito habitat: Bush, stagnant water etc...
- Spray mosquitoes with insecticide
- Use of antimalarial drugs
- Use of insect repellent to prevent mosquitoes etc.
- Sleeping under mosquito nets

SECTION C: THIS QUESTION IS COMPULSORY

17.

a) Salivary glands and pancreas well labelled.

b)

i. Amylase, starch disappears or broken down by digestion / hydrolysis, Maltose or glucose is formed. ii.

	Sample 1 (1 minute)	Sample 2 (10 minutes)
Starch test	Positive	Positive
Sugar test	Negative	Negative

iii. Add Benedict's solution, heat.

Observation: if sugar is present, it changes from blue-green-yellow- orange-red/brown.

c)

- In the small intestines / duodenum / ileum
- Large surface area, many capillaries / capillary network / good blood supply, thin surface.
- Diffusion or active transport.

REPUBLIC OF RWANDA



RWANDA EDUCATION BOARD (REB)
P.O.BOX 3817 KIGALI

BIOLOGY I

001

06th Nov. 2013 08.30 am – 11.30 am

ORDINARY LEVEL NATIONAL EXAMINATIONS 2013

SUBJECT: BIOLOGY I

DURATION: 3 HOURS

INSTRUCTIONS:

This paper consists of **three** sections **A**, **B** and **C**

Answer **ALL** questions in section A. **(55 marks)**

Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

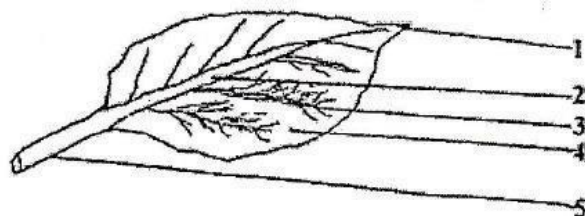
SECTION A: Attempt all questions from this section. (55 marks)

1. (a) Name ONE characteristic feature common to fish, reptiles and birds but not found in mammals **(1 mark)**
 (b) Name the kingdom to which each of the following belongs:
 i. Grass ii. Mould iii. Spirogyra **(3 marks)**

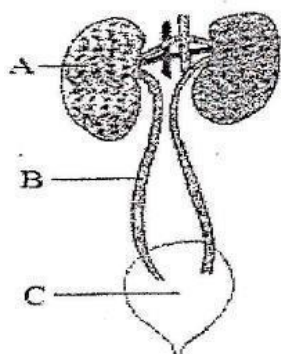
2. Copy and complete the table below: **(4 marks)**

ANIMAL	PHYLUM	CLASS
Cockroach		
Toad		
Centipede		
Elephant		

3. The diagram below shows the structure of a leaf.

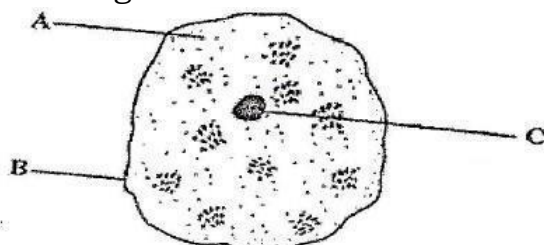


- a) Identify the parts labelled 1,2,3,4 and 5. **(5 marks)**
 - b) What are the functions of parts labelled 4 and 5? **(2 marks)**
 - c) State two ways in which the external structure of the leaf is modified to perform its function. **(2 marks)**
4. (a) Where in the body are red blood cells made? **(2 marks)**
 (b) State three ways in which red blood cells are specialized to carry out their functions. **(3 marks)**
 5. What is the difference between excretion and egestion? **(2 marks)**
 6. Knowledge acquired through the study of BIOLOGY can help us to fight against HIV/AIDS and other sexually transmitted diseases. Explain how this can help you. **(4 marks)**
 7. The diagram below shows part of the system that controls the amount of water in the body.



- a) Give the name and the function of each labelled part. **(5 marks)**
 b) This system also excretes a substance called urea. Why is it necessary in body? **(1 mark)**

8. The diagram below shows an animal cell.



Name each labelled part and explain its functions.

(6 marks)

9. Animals and plants carry out common life processes like exchanging gases and excretion. Copy and complete the table to name or describe processes common to all animals and plants. **(6 marks)**

Name of the life process	Description
.....	Living things produce off springs
.....	Living things get bigger and develop
.....	Living things change the position of their body, or part of their body.
Respiration	.....
Feeding or nutrition	.....
.....	Detect and respond to changes in the environment.

10. (a) How does glucagon increase glucose level in the blood? **(2 marks)**
 (b) How does glucagon effect differ from that of insulin? **(2 marks)**
11. Give the functions of the following hormones in the human body.
 a) Follicle stimulating hormone. (FSH)

- b) Progesterone
- c) Antidiuretic hormone. **(3 marks)**

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

- 12.** (a) Bile is produced by the gallbladder. It contains no enzymes. What is its function? **(2 marks)**
(b) Give at least four enzymes present in the pancreatic juice and a function of each. **(8 marks)**
- 13.** (a) Mice (rats) with black fur can have the genotype **BB** or **Bb**, while mice with brown fur have the genotype **bb**.
i) Use a genetic diagram to show what fur colour you would predict in the F1 offspring produced by two mice which are both Bb. **(3 marks)** **ii)** Why might your predictions of fur colour in F1 generation NOT be proved right? **(1 mark)**

(b) i) What is the difference between dominant and recessive alleles? **(2 marks)**

ii) What is the difference between alleles and genes? **(2 marks)** iii) Describe the difference between homozygous and heterozygous chromosomes. **(2 marks)**

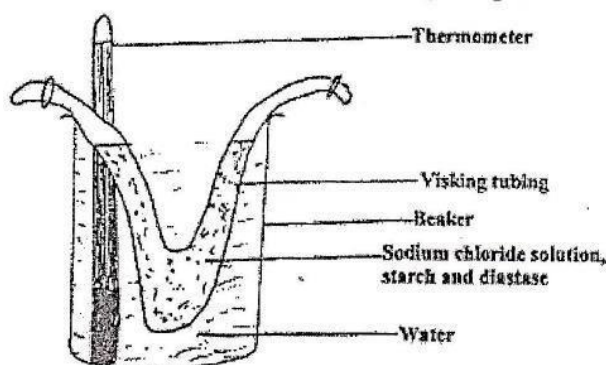
14. Use a table to show the differences between exocrine and endocrine glands. Give the similarities of these glands. **(10 marks)**

15. (a) Write STD's in full and give two examples of STDs. **(3 marks)**
(b) Outline the general symptoms of STDs common to both men and women. **(7 marks)**

16. (a) What is the advantage to an animal of having capillaries which are:
i. Very narrow? **(2 marks)** ii. Repeatedly branched? **(2 marks)** iii. Very thin walled? **(2 marks)**
(b) How do you think microscopic animals can survive without having a circulatory system? **(4 marks)**

SECTION C: THIS SECTION IS COMPULSORY: (15 MARKS)

17. The experiment below is used to demonstrate a biological process.



Visking tubing is made of material which acts as a semi-permeable membrane. After some time water from the beaker entered the visking tubing and water in the beaker became salty. The temperature of the experiment was kept between 35°C and 40°C throughout the experiment.

a) By what process has water entered the visking tubing? **(1 mark)**

b) Give an example of the process in (a) above occurring in:

i. Animal cell

ii. Plant cell. **(4 marks)** c) By what process has salt entered water in the beaker? **(1 mark)**

d) Give an example of the process in (c) above occurring in:

i. Animal cell

- ii. Plant cell. **(4 marks)** e) i) Name one more substance, you think has entered the water in the beaker by the same process as salt. **(1 mark)** ii) How can you test for the presence of that substance? Give details of your test. **(4 marks)**

**MARKING SCHEME OF ORDINARY LEVEL BIOLOGY
NATIONAL EXAMINATION 2013**

Section A: Answer all questions

1.

a) All lay eggs.

b)

i. Grass: kingdom plantae

ii. Mould: kingdom fungi

iii. Spirogyra: kingdom protocista / protista

2.

Animal	Phylum	Class
Cockroach	Arthropoda	Insecta
Toad	Chordata	Amphibia
Centipede	Arthropoda	Chilopoda
Elephant	Chordata	Mammalia

3.

a) 1: apex, 2: midrib, 3: vein, 4: lamina, 5: leaf stalk

b) 4: it traps sunlight for photosynthesis to take place, 5: attaches leaf to stem.

c) It is broad to trap sunlight for photosynthesis.
It has veins which transport manufactured food.

4.

a) In the bone marrow.

b) They are numerous to transport blood.

They have haemoglobin to transport oxygen.

They lack a nucleus for more space.

They are bi-concave for easy movement.

They are thin for easy diffusion of gases.

5. Excretion is the removal of waste products of metabolism from the body while egestion is the removal of undigested food from the body.

6. The knowledge teaches us how to:

- Abstain from sexual activities in order to prevent the spread of AIDS
- To know which preventive measures that can be used against the spread of HIV/AIDS e.g. Condoms
- Encourage married people to remain faithful to each other
- To know how the virus reproduces and how minimize it from spreading
- To know which instruments to avoid using e.g. sharp objects

7.

a) A - Right kidney: function: it filters blood to form urine.

B- Right ureter: function: it conducts urine from the kidney to the bladder

C- Bladder: function: it stores urine temporarily before it is removed to the outside of the body.

b) It helps to keep the blood concentration constant.

8.

Part	Name	Function
A	Cytoplasm	It contains cell organelles
B	Cell membrane	It separates the cells content from the outside of the cell.
C	Nucleus	It controls all cell's activities

9.

Name of the life process	Description
Reproduction	Living things produce off springs
Growth	Living things get bigger and develop
Movement	Living things change the position of their body, or part of their body.
Respiration	Living things produce energy
Feeding or nutrition	Living things need food to survive.
Irritability	Detect and respond to changes in the environment.

10.

- a) It causes the liver cells to convert glycogen into glucose. It also causes the conversion of stored fats into glucose.
- b) Glucagon increases the levels of glucose in blood while insulin lowers the levels of blood glucose.

11.

- a) FSH stimulates the development of follicles. It also causes the release of oestrogen.
- b) It causes the thickening of uterus walls
- c) It causes increase in water reabsorption from the kidney.

SECTION B: ANSWER ONLY THREE QUESTIONS

12.

- a) The role of bile is to cause emulsification of fats and to neutralise the acid coming from the stomach.

b)

Name of enzyme	Function
Pancreatic amylase	To break down starch to maltose
Trypsin	To break down proteins to dipeptides
Lipase	To break down lipids to fatty acids and glycerol
Chymotrypsin	To break down proteins to dipeptides

13.

Parent: Male x

a) Female

i. Phenotype: Black x black

Genotype: Bb x Bb

Gametes: B, b and B,

b.

Gametes	B	b
B	BB	Bb
b	Bb	bb

Phenotypes: 3
Black: 1 Brown

ii.

This is because the predications are just a

probability. b)

- i. Dominant alleles are those which express themselves in the phenotype even in absence of another while recessive

alleles are those which express themselves in the phenotype only in the presence of another.

- ii. Alleles are any one of two or more forms of the same gene that occur on a chromosome while genes are segments of DNA that carry information on a specific protein. iii. Homozygous chromosomes and heterozygous chromosomes

14. Similarities of endocrine and exocrine glands

- Both produce chemical substances
- Both are controlled by autonomic nervous system.
- Both are found in the epithelial tissue

Differences between endocrine and exocrine glands

15. ENDOCRINE GLAND	EXOCRINE GLAND
Are ductless glands	Are ducted glands
Their products are released directly into the blood	Their products are released into the lumen or the outside of the body
Produce hormones	Do not make hormones
They have target organs on which they act	No target organs
Their products are mainly proteins in nature	They produce various types of substances
They have internal secretion	They have external secretion

a) STD's - sexually Transmitted Diseases e.g. AIDS, syphilis, Gonorrhoea b)

- A discharge from the penis, urethra, vagina, or anus. The discharge may be blood-streaked, and it may or may not have a strong odour.
- Genital and/or anal itching or irritation.
- A anus, or rash, blisters mouth., sores, lumps, bumps, or warts on or around the genitals,

- *Burning or pain during urination.*
- *Swollen lymph glands in the groin.*
- *Pain in the groin or lower belly.*
- *Pain or swelling of the testicles, Swelling or redness of the vagina.*
- *Weight loss, loose stools and night sweats.*
- *Flu-like symptoms (such as aches and pains, fevers, and chills).*
- *Painful sex,*
- *Bleeding from the vagina other than during a monthly period.*

16.

a)

- i. *Narrow capillaries increase the blood pressure hence faster blood flow.*
- ii. *This ensures that all body cells are well covered and can get all the body needs.*
- iii. *To allow easy diffusion of gases across the wall.*

b) *They have a smaller size and. because of that, their surface area to volume ratio is very bigger. Because of this, nutrients and even gases can easily move in and out passively by use of diffusion process.*

SECTION C: THIS QUESTION IS COMPULSORY

17.

a) Osmosis

b)

- i. *During water absorption in the ileum and also during formation of tissue fluid.*
- ii. *During water absorption in root hairs.*

c) Diffusion

d)

i. Uptake of gases via the alveoli surface.

Absorption of nutrients in the intestines.

ii. Absorption of salts by roots, gaseous exchange in the stomata. e)

i. Maltose

ii. Test for maltose **Apparatus:**

- Test tubes
- Benedict's solution
- Heat source, dropper, beaker

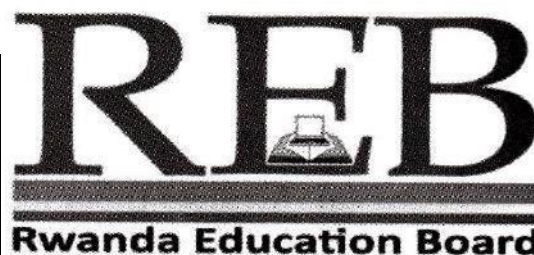
Procedure: Place 2cm^3 of the solution (from the beaker) in a test tube followed by 2cm^3 of Benedict's solution and heat.

Observation: The blue colour of benedict's solution turns to green to yellow and finally red brown.

BIOLOGY I

001

04 Nov. 2014 08.30 am – 11.30 am



ORDINARY LEVEL NATIONAL EXAMINATIONS, 2014

SUBJECT: BIOLOGY I

DURATION: 3 HOURS

INSTRUCTIONS:

1. Write your name and index number on the answer booklet as written on your registration form.
2. Do not open this paper until you are told to do so.
3. This paper consists of **three** sections **A**, **B** and **C**

Answer **ALL** questions in section A. **(55 marks)**

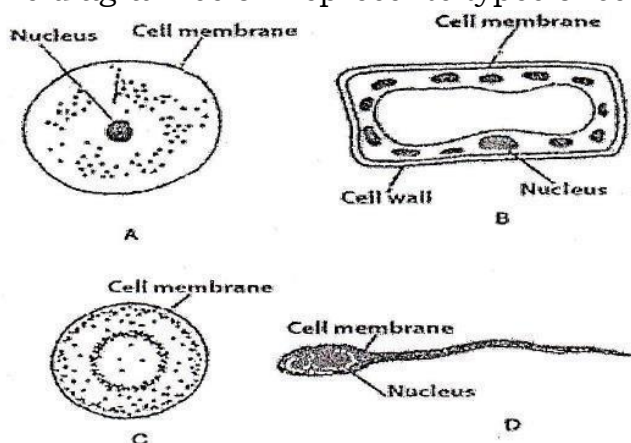
Answer **THREE** questions in section B. **(30 marks)**

Answer only **one** question in section C **(15 marks)**

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

SECTION A: Attempt all questions from this section. (55 marks)

1. The diagram below represents types of cells.



Which of these represents animal cells? Explain your answer. **(3 marks)**

2. Using $\checkmark$ and X, indicate the parts of the cell found in a plant and animal cell. The first one has been done for you. **(5 marks)**

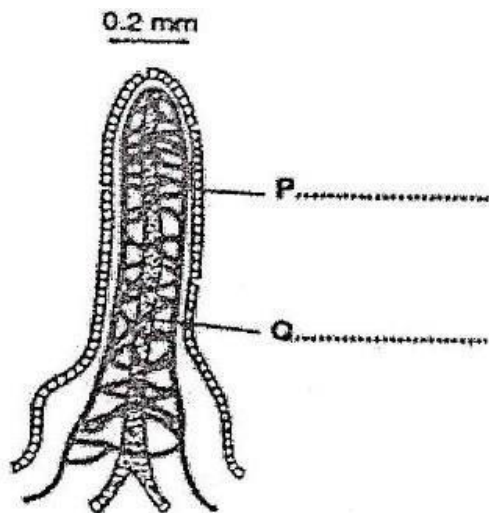
Part	Plant cell	Animal cell
Nucleus	$\checkmark$	$\checkmark$
Cell membrane		
Cytoplasm		
Cell wall		
Large vacuole		
Chloroplasts		

3. Blood contains plasma, red blood cells, white blood cells and platelets. Give the function of each:

- a) Plasma **(1 mark)**
b) Red blood cells **(1 mark)**
c) White blood cells **(1 mark)**
d) Platelets **(1 mark)**

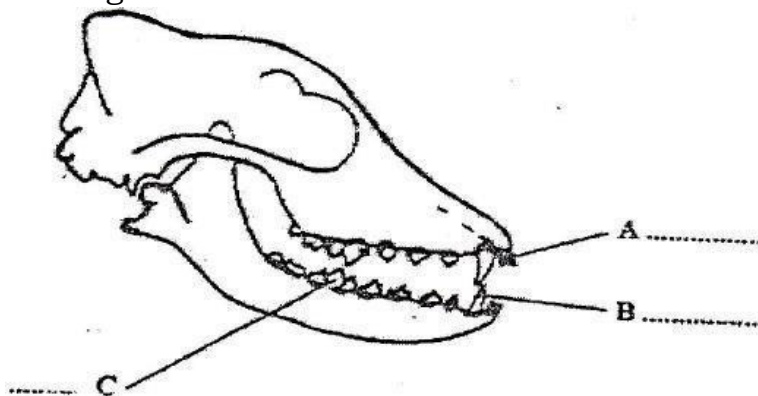
4. a) Distinguish between saprophytes and parasites. **(2 marks)**

- b) i.** Name a common disease in Rwanda caused by protozoa. **(1 mark)**
 ii. Suggest methods that can be used to control the disease you named in b (i). **(3 marks)**
5. What substances are transported by:
a) The vascular systems of a flowering plant? **(2 marks)**
b) The blood system of mammals? **(2 marks)**
6. (a) Why is mucus needed to protect the cell lining the gut from protein-digesting enzymes? **(2 marks)**
 (b) The pH in the stomach is very acidic about pH 2. Why would it be a problem if the pH in the small intestines was 2? **(2 marks)**
7. An experiment was done to investigate effects of bile on lipid digestion. Lipase enzyme and bile were added to a lipid test tube A. Test tube B only had the lipid and lipase .enzyme. Explain why:
a) The pH in test tube A became acidic. **(2 marks)**
b) The reaction in test tube B was very slow. **(1 mark)**
8. Explain why the elimination of water by the kidney may be considered to be both excretion and osmoregulation. **(4 marks)**
9. Why is it more accurate to describe fish as a ‘variable-temperated’ animal rather than cold-blooded? **(2 marks)**
10. (a) How is a zygote different from any other cell in the body? **(2 marks)** (b) Why is it difficult to decide whether viruses are living organisms? **(3 marks)**
11. The diagram below shows a villus in longitudinal section from ileum of a mammal.



- a) Name the parts labelled P and Q. (2 marks)
- b) What are the functions of P and Q? (2 marks)
- c) Explain how P is adapted to carry out its functions. (2 marks)

12. The diagram below shows the side view of a skull of a carnivore.



Label the teeth A, B and C. (2 marks)

13. Choose words from the list to complete the sentences that follow. Each word may be used once or not at all.

Cells; Chloroplast; Chromosomes; Genes; Organs; Organisms; Nucleus; Tissues.

Each body cell contains a. (i) which controls the cell's activities and characteristics. This contains pairs of. (ii) which are made up of a number of small units of inheritance called (iii) A collection of similar cells working together are called (iv) These make up (v) which work together as systems allowing(vi) to survive. (6 marks)

SECTION B: ATTEMPT ANY THREE QUESTIONS.

(30 marks)

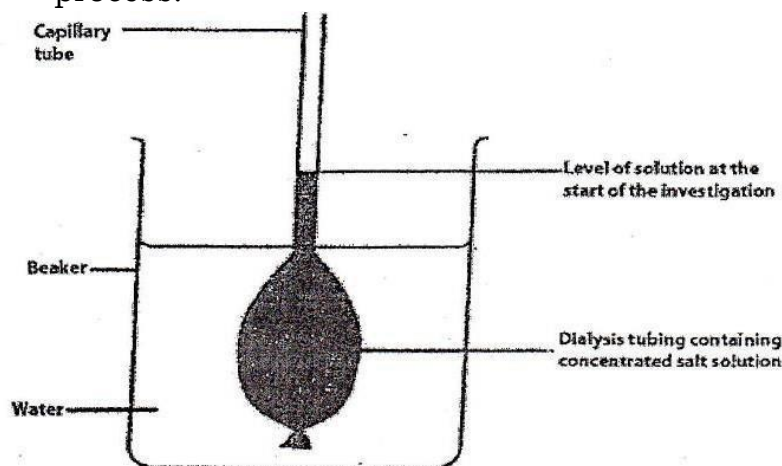
14. Briefly explain how:

a) The flow of blood is maintained in a mammal. (5 marks)

- b) The flow of water is maintained in a flowering plant. **(5 marks)**
15. a) (i) What are hormones? **(1 mark)**
 (ii) Where are hormones produced? **(1 mark)**
 b) Which hormones are produced by the pancreas? **(5 marks)**
 c) Explain how the blood sugar level in blood is controlled. **(5 marks)**
16. a) How is AIDS transmitted from one person to another? **(4 marks)**
 b) Suggest all possible methods that can be used to avoid the AIDS virus. **(6 marks)**
17. Identify the various modes of asexual reproduction in plants and animals. **(10 marks)**
18. a) Define pollination. **(1 mark)** b) Name the types of pollination and characteristics of each. **(9 marks)**

SECTION C: COMPULSORY. (15 marks)

19. Some students set the experiment below to investigate a biological process.



- a)** (i) Name the process being investigated. **(1 mark)**
(ii) Define the process named in a(i) above. **(2 marks)**

- b)** (i) What will happen to the water level in the capillary tube during this investigation? **(1 mark)**
(ii) Explain what has happened in b(i) above. **(5 marks)**

- c)** Explain fully what happens when both animal and plant cells are put in beaker containing pure water. **(6 marks)**

**MARKING SCHEME OF ORDINARY LEVEL BIOLOGY
NATIONAL EXAMINATION 2014**

Section A: Answer all questions

1. *A, C and D because they don't have a cell wall, a large central vacuole and chloroplasts.*

2.

Part	Plant cell	Animal cell
<i>Nucleus</i>	√	√
<i>Cell membrane</i>	√	√
<i>Cytoplasm</i>	√	√
<i>Cell wall</i>	√	√
<i>Large vacuole</i>	√	X
<i>Chloroplasts</i>	√	X

3.

a) Plasma: transports nutrients, urea, hormones, blood cells...

b) Red blood cells: transports oxygen and carbon dioxide.

c) White blood cells: body defence, production of antibodies.

d) Platelets: blood clotting.

4.

a) Saprophytes are organisms which feed on dead decaying organic matter while parasites depend on other organisms for both food and shelter. A parasite is an organism which benefits from another (host) causing harm to the host.

b)

i. Malaria is caused by Plasmodium.

ii. Sleep under mosquito nets; remove stagnant water around homes; spray with insecticides; remove bushes around houses.

5.

a) Xylem: water and mineral salts

Phloem: water, sucrose, amino acids.

b) Water, blood proteins, glucose, fats, amino acids, salts, vitamins, carbon dioxide, blood cells, oxygen, hormones, waste products.

6.

a) Because cells are partly made of proteins and would be broken down into digestion and would cause ulcers.

b) This is a wrong PH for the enzymes in the gut because they would be denatured by acidity and would not work or the enzymes of the small intestines work at basic (alkaline) PH.

7.

a) Lipase breaks down lipids facilitated by bile salts of bile to fatty acids and glycerol. The emulsification of fats increases the surface area of lipids; this facilitates the activity of lipase enzymes. Fatty acids are acidic and lowers the PH.

b) Because there was no bile to emulsify the lipids for easy digestion or because there is no bile to facilitate lipase action.

8. Excretion of water is a metabolic product and is removed when in excess and osmoregulation in water is maintained to keep the water potential of blood more or less constant or to maintain water balance, maintain normal blood concentration.

9. Its body temperature is the same as or only a few degrees above its surroundings. This makes it very dependent on temperature changes. Or the temperature of the fish changes depending on the surroundings.

10.

a) A zygote is a product of fusion of male and female reproductive cells. All other cells of the body arise from the mitotic division of the zygote.

b) A virus when outside a cell cannot grow or reproduce. It does not feed, respire or excrete. These are characteristics of living things. It is for this reason that it is difficult to say whether it is living or not. The only living characteristic it shows is the ability to reproduce when inside a living cell, using materials supplied by the cells.

11.

- a) P - Epithelium (blood capillary network); Q - Lacteal (Lymphatic vessel)
- b) P absorbs amino acids and glucose and glucose/vitamins/mineral salts. Or transport, glucose/amino acids /mineral salts. Q absorbs fatty acids and glycerol.
- c) The lining of the epithelium is very thin or permeable membrane, extensive capillary network, rich blood supply etc.
12. A - incisors, B - Canine, C - Carnassials or molars
13. i) nucleus, ii) chromosomes, iii) genes, iv) tissues, v) organs, vi) organisms

SECTION B: ANSWER ONLY THREE QUESTIONS

14.

a) Maintenance of blood flow in a mammal

- The automatic stimulation of the pace maker that enables the continuous contraction of the cardiac muscles that allows the pumping of blood out of the heart to the rest of the body parts.
- Difference in ventricular muscles which enables blood to be pumped out of the heart at different pressures depending on the distance to be covered.
- Elasticity of the arteries that allows constrictions which maintains high pressure in arteries.
- Skeletal contractions maintain movement of blood in the veins.
- Thicker walls of arteries which maintain and withstand high pressure of blood.
- Presence of valves in veins and the heart that prevent the back flow of blood.
- Continuous blood supply to the heart muscles by coronary arteries which enables respiration for energy supply to allow the heart contractions.
- b)
- Transpiration pull
- Root pressure

- Capillary force
- Osmotic pressure □ Cohesion force □ Adhesion force.

15.

a)

- Hormones are organic substances secreted in minute quantities into the blood stream by endocrine glands or specialized nerve cells and regulate the growth or functioning of specific tissue.*
- Endocrine glands*

b) *Insulin, glucagon*

c) *When the blood glucose level increases, the beta cells of the pancreas releases insulin hormone. Insulin facilitates conversion of glucose to glycogen and fats, oxidation to glucose. The blood glucose level decreases to the set point. When the blood glucose level decreases, the alpha cells of the pancreas releases glucagon hormone. Glucagon stimulates the conversion of glycogen to glucose; fats to glucose; amino acids to glucose. The blood glucose level increases to the set point.*

16.

a) *Sexual contact with an infected person, use of hypodermic needles contaminated with infected blood, transfusion of infected blood, homosexual partners with infected people, drug users share needles and syringes, infected mothers can infect the foetus.*

b) *Use of condoms during sexual intercourse, setting up free needles schemes for those people who inject drugs, screening blood before transfusion, education programs to make people aware of the methods of transmission of the HIV virus and how they can be prevented, abstaining from sexual intercourse, faithfulness, avoid drug use, avoid blood contact during accidents, proper delivery of babies during birth (PMTCT).*

17. *Binary fusion, spore formation, vegetative propagation, natural layering, rhizomes, tubers, cutting, fragmentation, budding, grafting, suckers, cloning etc.*

18.

a) Pollination is the transfer of pollen from the stamen to the stigma of a flower.

b) Self-pollination, cross pollination.

c) **Characteristics of self-pollination:**

- Hermaphrodite flowers
- Anthers and carpels get mature simultaneously,
- Anthers are above the stigma
- Petals remain closed until pollination takes place
- Self-compatibility.

Characteristics of cross pollination:

- Anthers mature before stigma
- Self-sterility
- Stigma matures before anthers

SECTION C: THIS QUESTION IS COMPULSORY

19.

a)

i. Osmosis

ii. It is the movement of water molecules from their highest concentration to the lowest concentration through a semi-permeable membrane.

b)

i. The water level will rise in the capillary tube. ii. The solution inside the dialysis tubing exerts osmotic pressure on the water in the beaker and water molecules move from the beaker where there are more water molecules through the dialysis tubing which is acting as a semi-permeable membrane. This will continue until the salt solution is diluted enough. The water level in the beaker will also fall.

c) Water enters both cells because there are more water molecules in the beaker than there are in the cells. The animal cell will eventually swell until it bursts because its cell membrane cannot resist the internal pressure inside the cell. The plant cell however will not burst because it has a cell wall

outside the cell membrane which is strong enough to resist the internal pressure inside the cell.

BIOLOGY I

001

18/11/2015 08.30 AM – 11.30 AM



ORDINARY LEVEL NATIONAL EXAMINATIONS, 2015

SUBJECT: BIOLOGY I

DURATION: 3 HOURS

INSTRUCTIONS:

1. Write your names and index number on the answer booklet as they appear 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 paper until you are told to do so.
3. This paper consists of **three** sections **A**, **B** and **C**

- | | |
|---|-------------------|
| ☐ Answer ALL questions in section A. | (55 marks) |
| ☐ Answer THREE questions in section B. | (30 marks) |
| ☐ Answer only one question in section C | (15 marks) |

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

SECTION A: Attempt all questions from this section. (55 marks)

1. The following are various sub-units into which species of plants or animals can be divided: cell, organ, organelle, organism, tissue, organ system.
(a) Arrange them in order starting with the simplest and ending with the most complex. **(3 marks)**
(b) Which of them can be applied to the following:

(iii) Amoeba? **(1 mark)**

(iii) Leaf? **(1 mark)**

(iv) Chloroplast? **(1 mark)**

(v) Alimentary canal? **(1 mark)**

(i) A cat? **(1 mark)**

(1 mark)
2. Name the cells in a mammal that:
(a) Are sensitive to their environment. **(1 mark)** (b) Receive messages from sensory cells. **(1 mark)**
(c) Transmit messages to effectors. **(1 mark)**
3. Name the stage in the life cycle of flies and butterflies at which:
(a) Ecdysis occurs. **(1 mark)**
(b) Feeding for growth occurs. **(1 mark)**
(c) Wings appear. **(1 mark)**
(d) A period of immobility occurs. **(1 mark)**
4. 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. **(3 marks)**
5. a) Define photosynthesis. **(2 marks)**
b) What conditions are necessary for photosynthesis to occur in a green plant? **(4 marks)**
6. a) List two chemical elements other than carbon, hydrogen, oxygen and nitrogen which are required by both plants and animals. **(4 marks)** b) For each of the elements you have listed, give one reason why it is required:

i) In green plants.

(ii) In mammals.

(1 mark)

(1 mark)
7. Match the following ecological terms with their definitions. (a) Community - A place where an organism lives.

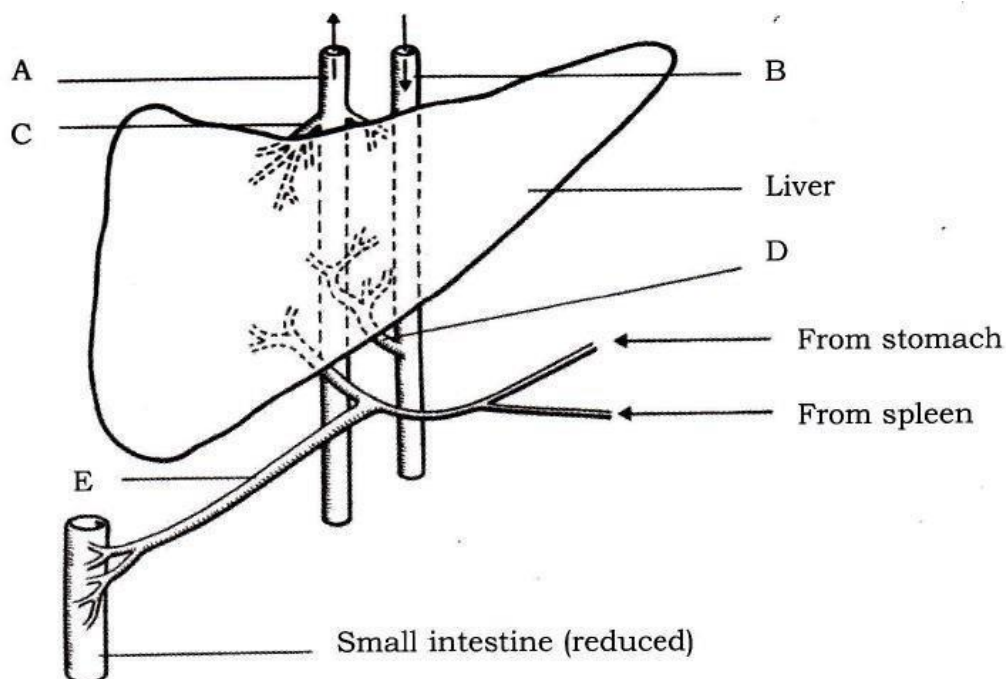
- b) Ecosystem - A number of species interacting in a locality
- c) Food web - A nutritional interrelationship of organisms
- d) Habitat - Interaction of organisms with each other and with their abiotic environment. **(3 marks)**

8. a) Why are enzymes frequently referred to as 'biological catalysts'? **(4 marks)**

b) What would be the effect of changing:

- (i) pH?
- (ii) Temperature upon the rate of action of any named enzyme? **(2 marks)**

9. The diagram below shows blood supply through the liver.



(a) Label the parts indicated A, B, C, D, E. **(5 marks)**

(b) Which two substances would be present in greater concentrations in vessel E after a meal? **(2 marks)**

10. Give at least four functions of a human brain. **(4 marks)**

11. When a person's hand accidentally touches a hot object it is quickly withdrawn. Explain what causes this response. **(3 marks)**

12. a) Define a gamete. **(1 mark)**

b) What are the male and female gametes in an animal (mammal)? **(2 marks)**

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

13. a) Explain the following terms that are used in genetics:

- (i) Allele (1 mark)
- (ii) Heterozygous (1 mark)
- (iii) Phenotype (1 mark)

b) In humans, brown eye (B) is dominant to blue eye (b). Two parents, one heterozygous for eye colour and the other blue eyes, start a family.

(i) What is the genotype of the brown-eyed parent? (1 mark) (ii)

What are the possible gametes that each parent can produce?

(2 marks)

(iii) Show the possible genotypes of their children.

(4 marks)

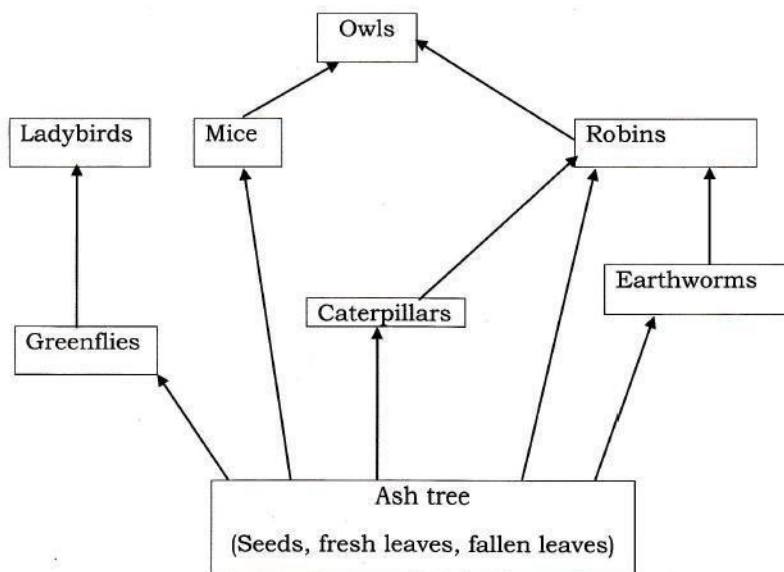
14. a) Explain the following terms that are used in ecology.

(i) Biosphere (1 mark) (ii) Habitat (1 mark) (iii) Niche (1 mark)

(iv) Producer

(1 mark)

b) Answer the following questions in relation to the food web shown below.



(i) Write two food chains with four organisms in it.

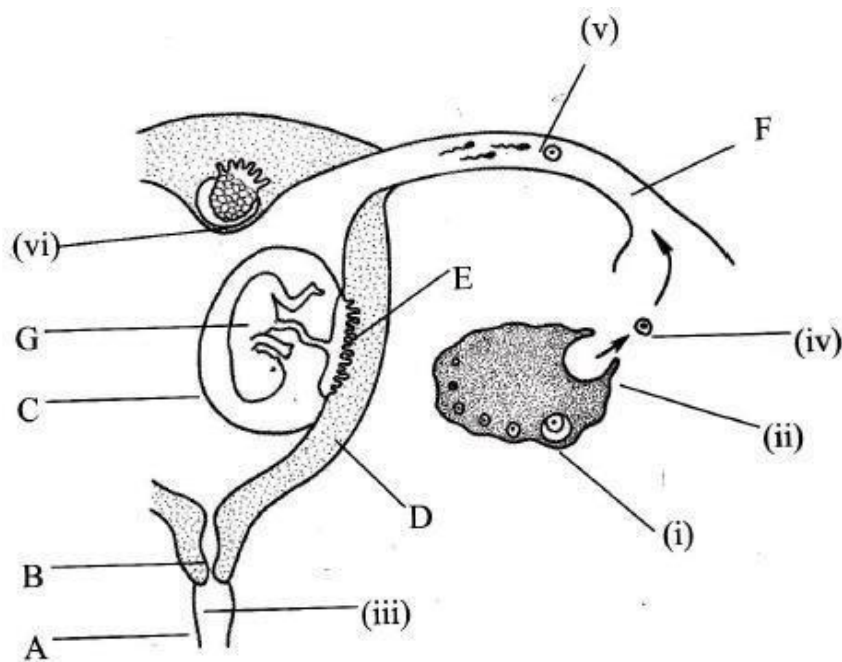
(2 marks)

(ii) Copy and complete the table below.

(4 marks)

Autotrophic organism	
Secondary consumer	
Omnivore	
Carnivore	

15. a) Describe the effects of the failure of the pancreas to produce sufficient insulin. **(2 marks)**
- b) The pituitary gland produces several hormones.
- (i)** Give any four (4) hormones it produces. **(4 marks)**
- (ii)** Give the functions of each hormone named in (b) (i) above. **(4 marks)**
16. a) The diagram below represents the events leading up to fertilization implantation and development in human beings.



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

b) Briefly describe the process of fertilization in human beings, from (i) to (v). **(6 marks)**

17. (a) State one function of each of the

(i) Petal **(1 mark)** (ii) Sepal **(1 mark)**

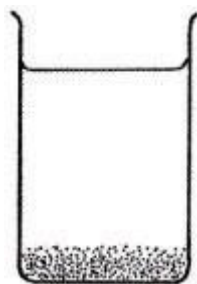
b) What is the difference between self-pollination and cross-Pollination? **(2 marks)**

(c) Some species of plants are strongly adapted to pollination by certain insects. State four characteristics which are regarded as adaptations to pollination by bees. **(4 marks)**

(d) In dicotyledonous plants, the early stages of germination take place in the soil where there is little or no light for photosynthesis. How does the seedling obtain materials for its growth and energy during this time? **(2marks)**

SECTION C: THIS SECTION IS COMPULSORY. (15 marks)

18. a) The diagram below represents molecules of a salt dissolved in the bottom layer of water in a beaker.



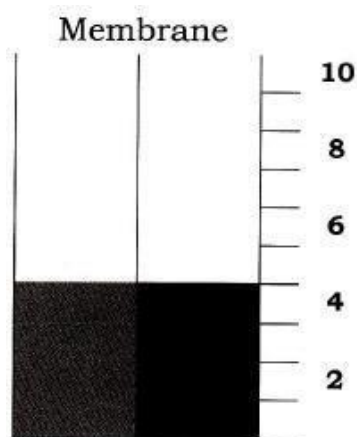
b) Make two similar diagrams to the distribution of salt molecules:

(i) After a few minutes. **(2 marks)**

(ii) After several hours. **(2 marks)**

(iii) By which transport mechanism (process) the salt molecules will move?
(1 mark)

(b) The diagram below shows a vessel which contains a concentrated (right) and a dilute (left) solution separated by a partially permeable membrane.



i) Draw a similar diagram to show the liquid levels after an hour or two hours. **(2 marks)**

ii) Explain what has happened. **(4 marks)**

iii) Name the process which is being investigated. **(1 mark)**

iv) Define the process named in (iii) above. **(3 marks)**

MARKING OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2015

Section A: Answer all questions

1.

a) *Organelle, cell, tissue, organ, organ system*

b)

- i. Organism
 - ii. Organism (or cell)
 - iii. Organ
 - iv. Organelle
 - v. Organ system
- 2.
- a) Receptor cells
 - b) Sensory neurons
 - c) Motor neurons
- 3.
- a) Larva stage and adult stage
 - b) Larva stage
 - c) Pupa stage
 - d) Pupa stage
4. Drinking boiled water, proper sanitation, proper disposal of wastes, covering food, washing hands before eating...
- 5.
- a) **Photosynthesis** is a metabolic process by which plants and other autotrophic organisms make their own food using water and carbon dioxide in presence of sunlight and chlorophyll.
 - b) **Conditions necessary for photosynthesis:** presence of water, carbon dioxide, suitable temperature, presence of chlorophyll or chloroplasts.
- 6.
- a) Magnesium, iron
 - b)
 - i. In plants: magnesium is required in the synthesis of chlorophyll
 - ii. In animals: iron is used in the synthesis of haemoglobin
- 7.
- a) Community: A number of species interacting in a locality
 - b) Ecosystem: Interaction of organisms with each other and with their abiotic environment.
 - c) Food web: A nutritional interrelationship of organisms
 - d) Habitat: A place where an organism lives.
- 8.

- a) **Enzymes** are frequently referred to as biological catalysts because they speed up the rate of chemical reactions in living organisms.
 - b) Changing the PH on an enzyme controlled reaction will affect the enzymes. Enzymes have optimum PH at which they work. When the PH is changed, the enzymes change shape so that their substrate cannot fit in their active sites. This is called enzyme denaturation.
 - c) Changing the temperature on an enzyme controlled reaction will affect the enzymes. Enzymes have optimum temperature at which they work. When the temperature is changed, the enzymes will be denatured.
- 9.
- a) A: vena cava; B: aorta; C: hepatic vein; D: hepatic artery; E: hepatic portal vein
 - b) Glucose, amino acids
10. Thinking, reasoning, storage of information, memory, love, imagination, vision...
11. It is a reflex action. A reflex action is an automatic response to a stimulus which not under the control of the brain. Reflexes are controlled by the spinal cord. The command from the spinal cord makes the muscles of the hand to contract, removing the hand from the hot object (stimulus).
- 12.
- a) A gamete is a cell involved in sexual reproduction.
 - b) The male gamete is the sperm. The female gamete is the egg.

SECTION B: ANSWER ONLY THREE QUESTIONS

- 13.
- a)
 - i. **Alleles** are different forms of the same gene.
 - ii. **Heterozygous:** having different alleles for a given character.

iii. **Phenotype:** the physical appearance of an organism.

b) Brown eye is dominant: B

Blue eyes is recessive: b

Cross between two parents: one heterozygous (Bb) and the other with blue eyes (bb)

- i. Genotype of the brown-eyed parent: bb
- ii. The possible gametes that each parent can produce: B and b from the parent with genotype Bb and b from the parent with genotype bb.
- iii. The possible genotypes of their children

Gametes	B	b
b	Bb	bb
b	Bb	bb

Genotypes: 50 % Bb; 50 % bb

14.

a)

- i. **Biosphere** is the place on Earth where life is possible.
 - ii. **Habitat** is the place where an organism lives.
 - iii. **Niche** is the role of the species in the ecosystem.
 - iv. **Producer:** is an organism that can make its own food.
- b)
- i. Ash tree → Caterpillars → Robins → Owls
 - ii. Ash tree → Eartworms → Robins → Owls
 - iii.

Autotrophic organism	Ash tree
Secondary consumer	Robins, ladybirds
Omnivore	Robins
Carnivore	Owls

15.

a) The failure of the pancreas to sufficient insulin will lead to a disorder called **diabetes mellitus**.

b)

i. Growth hormone (GH), TSH, ACTH, prolactin, FSH, LH ii.

- **Growth hormone (GH):** Stimulates growth especially of bones of limbs and metabolic functions.
- **TSH:** Synthesis and secretion of thyroid hormones, growth of thyroid glands.
- **ACTH:** Stimulates the adrenal cortex to secrete its hormones
- **Prolactin:** stimulates milk production and secretion
- **FSH:** In male, stimulates spermatogenesis. In female, growth of ovarian follicles
- **LH:** In male, testosterone production. In female, secretion of oestrogens and progesterone, ovulation and maintenance of corpus luteum.

16.

a)A: vagina; B: cervix; C: amniotic sac; D: uterus; E: placenta; F: oviduct; foetus.

b)(i): Growth of an ovarian follicle

(ii) The ovary ruptures to release an egg (ovulation)

(iii) Sperm are introduced in the vagina during sexual intercourse.

(iv)The egg moves toward the oviduct.

(v) The sperm meets the egg and one of the sperm fertilizes the egg forming a diploid zygote. The zygote spends the next few days traveling down the Fallopian tube. As it travels, it divides by mitosis several times to form a ball of cells called a **morula**. The cell divisions, which are called **cleavage**, increase the number of cells but not their overall size. More

cell divisions occur, and soon a fluid-filled cavity forms inside the ball of cells. At this stage, the ball of cells is called a **blastocyst**.

(vi) The blastocyst embeds in the wall of the uterus. This is called implantation.

17.

a)

i. **Sepals:** protection of inner parts of the flower (reproductive organs).

ii. **Petals:** attract pollinators such as bees and insects.

b) **Self-pollination** is the transfer of pollen grains from the anthers to the stigma of the same flower. In other words, it is the transfer of pollen grains between flowers of the same plant. **Cross pollination** is the transfer of pollen grains from the anthers of one flower to the stigma of another flower of another plant of the same species. c)

- Are scented (have a pleasant strong smell)
- Are large and conspicuous (very noticeable or tending to attract attention).
- Pollen grains are rough, sticky on insect's body
- Are brightly coloured
- Produce nectar

d) The seedling obtains materials and energy from its growth from the endosperm. The endosperm contains storage molecules which are hydrolysed into simple monomers to be used by the seedling before it starts producing food by its own.

SECTION C: THIS QUESTION IS COMPULSORY

18.

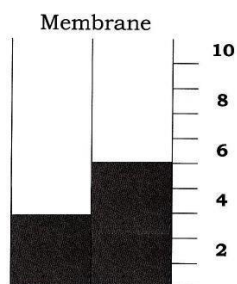
a)

i. A diagram showing salt molecules that are moving from the bottom upwards (salt molecules are moving from their highest concentration to their lowest concentration).

- ii. A diagram showing salt molecules with a uniform distribution in the water.
- iii. Diffusion.

b)

i.



ii. Water molecules has moved from hypotonic solution to hypertonic solution through a selectively permeable membrane. This is because always water moves from a medium with high water potential

(hypotonic solution) to a medium with a low water potential (hypertonic solution) through a selectively permeable membrane.

iii. Osmosis

iv. Osmosis is a movement of water molecules from a medium with high water potential (hypotonic solution) to a medium with a low water potential (hypertonic solution) through a selectively permeable membrane.

BIOLOGY

I 001

16 Nov. 2016 08.30 AM – 11.30 AM

REB
Rwanda Education Board

ORDINARY LEVEL NATIONAL EXAMINATIONS, 2016

SUBJECT: BIOLOGY I

DURATION: 3 HOURS

INSTRUCTIONS:

1. Write your names and index number on the answer booklet as they appear 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 paper until you are told to do so.
3. This paper consists of **three** sections **A**, **B** and **C**

- | | |
|---|-------------------|
| ☐ Answer ALL questions in section A. | (55 marks) |
| ☐ Answer THREE questions in section B. | (30 marks) |
| ☐ Answer only one question in section C | (15 marks) |

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

SECTION A: Attempt all questions from this section. (55 marks)

1. (a) Name two structures possessed by plant cells that are absent in the animal cell. **(2 marks)**
(b) Name the processes by which plant cells obtain their:
i. Mineral salts ii. Carbon dioxide
iii. Water **(3 marks)**

2. (a) Which organism:
- (i) Causes malaria? **(1 mark)**
- (ii) Transmits malaria? **(1 mark)**
- (b) How is AIDS transmitted? **(4 marks)**
3. (a) State the name of the type of muscle found in the heart. **(1 mark)** (b) Name the blood vessel that:
- i. Carry blood away from ventricles. **(2 marks)** ii. Carry blood back the ventricles. **(2 marks)**
4. (a) State two features of a good gaseous exchange system. **(2 marks)**
- (b) Describe the route taken by the air as it is inhaled. **(2 marks)**
- (c) Name the air sacs in the lungs. **(1 mark)**
5. Write T (true) or F (false) against the following statements. Anaerobic respiration in yeast.
- a) Produces carbon dioxide. **(1 mark)**
- b) Produces bread. **(1 mark)**
- c) Uses glucose. **(1 mark)**
- d) Needs oxygen. **(1 mark)**
- e) Liberates more energy than aerobic respiration. **(1 mark)**
6. Pair organisms (A – H) with their structures of gaseous exchange (a – e). One is done for you. **(7 marks)**
- | Organism | Gaseous exchange structures |
|--------------------|-----------------------------|
| A. Earthworm | (a) Tracheoles |
| B. Amoeba | (b) Alveoli |
| C. Insect | (c) Gill lamellae |
| D. Mammal | (d) Cell membrane |
| E. Fish | (e) Skin capillaries |
| F. Frog | |
| G. Flowering plant | |
| H. Yeast | |
7. The table below gives the energy content Kcal / 100 g of some common foods together with the percentages of fat, carbohydrate, protein and water in each.

Food	Kcal / 100 g	% A	% B	% C	% D
Butter	745	0.7	16.8	-----	82.5

Milk	68	3.3	88.3	4.4	3.6
Beef	318	23.5	55.0	-----	20.5
Potato	88	1.9	81.0	15.1	-----

a) Which food has the

(i) Highest energy value? **(1 mark)**

(ii) Lowest energy value? **(1 mark)**

(b) Which of the following corresponds to A, B, C, or D: proteins, carbohydrates, fats, water. **(4 marks)**

8. Blood contains plasma, platelets, red cells and white cells. Each has one or more important functions. Copy the table below and match each with its function. **(4 marks)**

Red cells	Fight bacteria
Platelets	Carry dissolved hormones
Plasma	Carry dissolved urea
White cells	Transport oxygen around the body.
	Helps blood to clot

9. Describe how oxygen is transported around the body cells. **(3 marks)**

10. Where are the following digestive substances produced? **(4 marks)**

- a) Bile
- b) Amylase
- c) Lipase
- d) Protease

11. In mice the gene for black hair colour (a) is recessive to the gene for Agouti (A) in which hair colour is not evenly distributed.

a) Give the genotype of:

(i) Pure breeding agouti mouse **(1 mark)** ii. A hybrid Agouti mouse **(1 mark)**

b) (i) Give the genotype of a black mouse. **(1 mark)**

(ii) Can a black mouse be produced by mating Agouti types? Explain your answer. **(2 marks)**

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

12. The table below indicates the estimated life expectancy, as a result of an HIV/AIDS infection in three Sub-Saharan countries in 1982 and 1999.

COUNTRY	LIFE EXPECTANCY
---------	-----------------

	1982	1999
A	59	39
B	54	50
C	58	48

a) State which country had:

(i) The smallest decrease in life expectancy between 1982 and 1999.

(1 mark)

(ii) The greatest decrease in life expectancy between 1982 and 1999.

(1 mark)

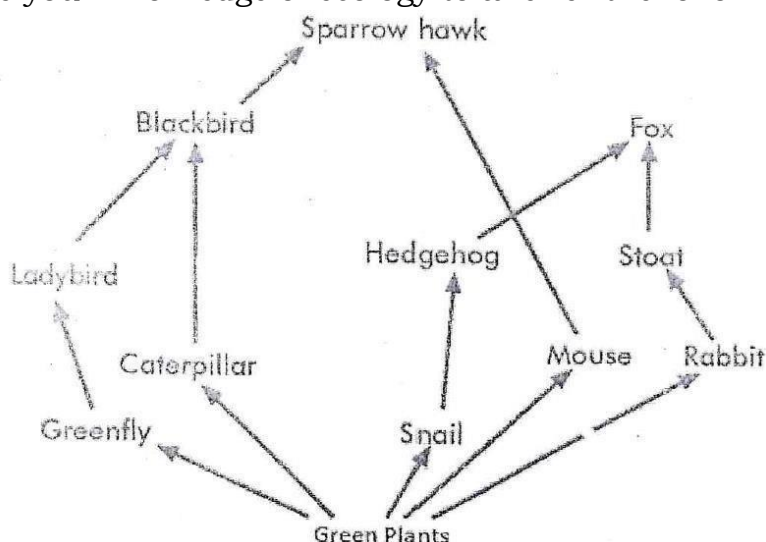
(b) Calculate the percentage decrease of life expectancy for country B between 1982 and 1999. Show your working.

(4 marks)

(c) Describe four ways in which HIV/AIDS infection can be prevented.

(4 marks)

13. Use your knowledge of ecology to answer the following questions:



(a) What name is given to the above diagram?

(1 mark)

(b) What do the arrows on the diagram mean?

(2 marks)

(c) Green plants are producers. What does this mean?

(2 marks)

(d) Name two primary consumers from the above diagram.

(2 marks)

(e) Name two carnivores from the above diagram.

(2 marks)

(f) Which trophic level does the hedgehog belong to?

(1 mark)

14. (a) Name the structure in a cell on which the genes are located. **(1 mark)**

(b) In pea plants the allele for tall (T) is dominant over the allele for dwarf (t).

A heterozygous tall plant is crossed with a dwarf plant.

(i) What are the genotypes of the parents? **(2 marks)** (ii) What are the possible gametes each parent can produce? **(3 marks)** (iii) Show the possible genotypes and phenotypes of the offspring.

(4 marks)

15. (a) Name a flying mammal. **(1 mark)**

(b) A frog is not a reptile. Give two specific reasons. **(2 marks)**

(c) What is the difference between cold-blooded and warm-blooded animals? **(2 marks)**

(d) A student says, "Most blooded animals take care of their young. Most cold-blooded animals do not." Explain. **(5 marks)**

16. (a) What are the lichens composed of? **(2 marks)**

(b) Show how the following non-flowering plants are important:

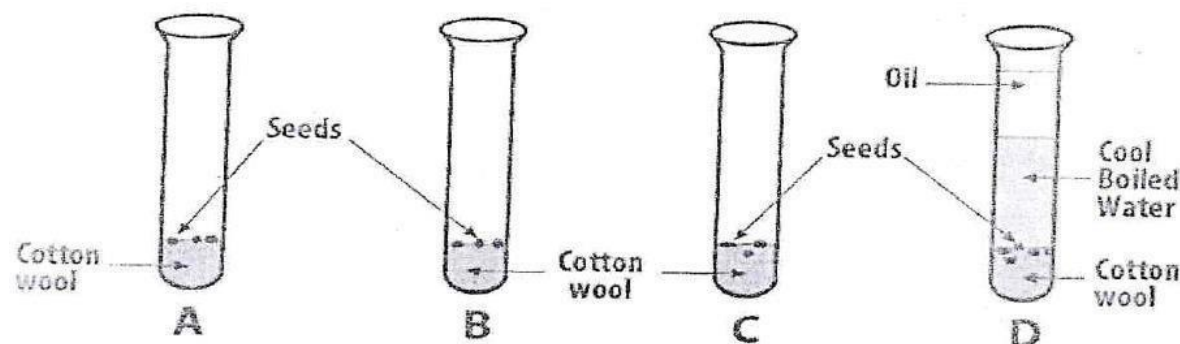
(i) Algae **(4 marks)**

(ii) Lichens **(4 marks)**

SECTION C: THIS QUESTION IS COMPULSORY

(15 MARKS)

17. Biology students carried out the following practical work to investigate the conditions necessary for seed germination.



a) Tube A has all the factors needed for germination. Tube B, C and D lack one essential factor each. Name the three factors that are present in tube A. **(3 marks)**

b) What is the purpose of putting oil in tube D? **(1 mark)**

c) Why were many seeds added to each tube rather than using just one seed in each tube? **(2 marks)**

(d) Which tube acted as a control? **(1 mark)**

(e) State the results of their investigation.

For Tube A: **(2 marks)**

For Tube B: **(2 marks)**

For Tube C: **(2 marks)**

For Tube D: **(2 marks)**

**MARKING SCHEME OF ORDINARY LEVEL BIOLOGY
NATIONAL EXAMINATION 2016**

Section A: Answer all questions

1.
 - a) *Cell wall and large vacuole*
 - b)
 - i. *Active transport*
 - ii. *Diffusion*
 - iii. *Osmosis*
2.
 - a)
 - i. *Plasmodium*
 - ii. *Anopheles mosquito*
 - b)
 - *Unprotected sexual intercourse with an infected person*
 - *Unscreened blood transfusion*
 - *Breastfeeding by an infected mother*
3.
 - a) *Cardiac muscle*
 - b)
 - i. *Pulmonary artery, aorta*
 - ii. *Pulmonary vein, vena cava*
4.
 - a) *It should be moist, it should have a large surface area. Should be thin and well supplied with capillaries.*
 - b) *Nasal cavity → Trachea → Bronchi → Bronchioles → Air sacs*
 - c) *Alveoli*
5.
 - a) *T* c) *T* e) *F*
 - b) *F* d) *F*
6.

A. Earthworm → (e) Skin capillaries

- B. Amoeba → (d) Cell membrane
- C. Insect → (a) Tracheoles
- D. Mammal → (b) Alveoli
- E. Fish → (c) Gill lamellae
- F. Frog → (d) Cell membrane
- G. Flowering plant
- H. Yeast → (d) cell membrane

7.

a)

- i. Butter
- ii. Milk

b) A: Proteins

- B: carbohydrates
- C: Water
- D: Fat

8. **Red cells:** transport oxygen around the body.

Platelets: help blood to clot

Plasma: carry dissolved hormones; carry dissolved urea.

White blood cells: fight bacteria

9. When oxygen is inhaled in the lungs, the alveoli enable it to be transferred into the blood. A small amount is transported in plasma. Red blood cells contain a protein called haemoglobin which helps the transport of oxygen from the lungs to the tissues. In the lungs, haemoglobin binds with oxygen forming oxyhaemoglobin. In the tissues, oxyhaemoglobin dissociates into oxygen and haemoglobin. The oxygen is used by cells in different metabolic activities. The heart is vital in moving blood around the body pumping 70 times per minute supplying the body with oxygen and removing metabolic waste products from the body.

10.

- a) Bile – liver
- b) Amylase – mouth and pancreas
- c) Lipase – pancreas
- d) Proteases – stomach and pancreas

a)

i. AA

ii. Aa

b)

i. Aa

ii. Yes, if the mating Agouti is hybrid e.g. Aa x Aa when crossed.

Parental phenotype: Agouti heterozygous x Agouti heterozygous

Parental genotypes: Aa x Aa

Gametes: A, a and A, a

Gametes	A	a
A	AA	Aa
a	Aa	aa

Offspring phenotypes: 75 % Agouti; 25 % Black

Offspring genotypes: 25 % AA; 50 % Aa; 25 % aa

SECTION B: ANSWER ONLY THREE QUESTIONS

12.

a)

i. B

ii. A $(54-50) \times 100$

b) % decrease = $\frac{54-50}{54} \times 100 = 7.4\%$

c)

- Screen blood before transfusion
- Treat infected mothers and avoid breastfeeding
- Use of condoms
- Test before marriage

13.

a) Food web

b) The flow of energy in the food web

- c) They are autotrophic i.e. they make their own food by a process of photosynthesis.
- d) Green fly, caterpillar, snail, mouse
- e) Black bird, sparrow hawk, hedgehog, fox.
- f) Third trophic level / secondary consumer.

14.

a) Chromosome

b)

- i. Tt, heterozygous tall plant; dwarf plant: tt
- ii. T, t and t
- iii. Parental phenotype: heterozygous tall x dwarf plant

Parental genotypes: Tt x tt

Gametes: T, t and t, t

Gametes	T	t
t	Tt	tt
t	Tt	tt

Offspring phenotypes: 50 % Tall; 50 % Dwarf

Offspring genotypes: 50 % Tt; 50 % tt

15.

a) A bat

b)

- It lays eggs with soft shells in the water. □ It has no scales

- *It lives in two environments: water and land.*
- *It makes metamorphosis.*

c) In cold blooded animals, the body temperature varies according to that of the environment. Warm blooded animals maintain constant their body temperature independently of the temperature of the surroundings.

d) This statement is correct because warm-blooded animals breast feed their young ones. Warm blooded animals ensure that young ones are kept warm at early stages of life. E.g. humans.

16.

a) Lichens are composed of algae and fungi

b) Importance of algae

- As indicators of atmospheric pollution □ For scientific research. □ As source of food
- Formation of medicine

Importance of lichens

- For scientific research
- Formation of laboratory PH indicator □ Food of animals.
- Food for insects and slugs
- Used as medicines

SECTION C: THIS QUESTION IS COMPULSORY

17.

a) Water, air, oxygen, warmth (temperature)

b) To prevent oxygen entry (penetration)

c) To increase the chances of germination

d) A and D.

e) A: Germination took place

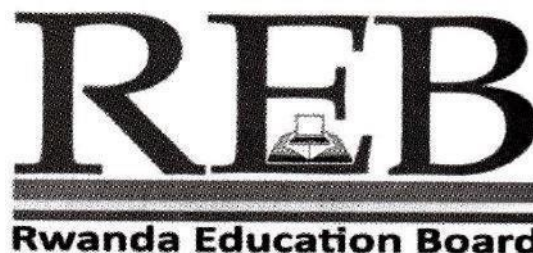
B: No germination took place
C: No germination took place

D: No germination took place

BIOLOGY I

001

28/11/2017 08.30 AM – 11.30 AM



ORDINARY LEVEL NATIONAL EXAMINATIONS, 2017

SUBJECT: BIOLOGY I

DURATION: 3 HOURS

INSTRUCTIONS:

1. Write your names and index number on the answer booklet as they appear 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 paper until you are told to do so.
3. This paper consists of **three** sections **A**, **B** and **C**

□ Answer **ALL** questions in section A.

(55 marks)

Compiled by HUNGURIMANA Dieudonné, 0788473140, ENDPK, HUYE

□ Answer **THREE** questions in section B. **(30 marks)**

□ Answer only **one** question in section C **(15 marks)**

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

168

SECTION A: Attempt all questions from this section. (55 marks)

1. (a) Give four (4) elements which plants need to produce their food. **(2 marks)**

(b) Plants and animals have a wonderful partnership. What do plants need from animals and what do plants produce that is needed by animals? **(3 marks)**

2. Write the appropriate answers required to complete the following sentences:

(Do not copy the sentences in the answer booklet; write the question number (a), (b), (c), (d) and the answers)

(a) Blood from the body (deoxygenated blood) enters the right side of the human heart through the blood vessel called the **(1 mark)**

(b) The deoxygenated blood is pumped through the pulmonary to the lungs. **(1 mark)**

(c) The oxygenated blood from the lungs enters the heart through the blood vessel called the **(1 mark)**

(d) The oxygenated blood from the heart is pumped to the body through the blood vessel called the **(1 mark)**

3. Copy and complete the following table. **(3 marks)**

Organisms	Kingdom
Bacteria	.....
Amoeba	Protista
Mushrooms	.....
Beans	Plantae

Man	
-----	-------

4. (a) Define the following underlined terms:
(i) Warm-blooded animals (1 mark)
(ii) Cold-blooded animals (1 mark)
 (b) Vertebrate animals are divided into five groups or classes: Mammals, Reptiles, Amphibians, Fish and Birds.
 Identify the groups in which the following animals are classified:
(i) Warm-blooded animals (2 marks)
(ii) Cold-blooded animals (2 marks)
5. (a) Name the sex chromosomes that are present in a human body cell of:

 male **(1 mark)**

 female **(1 mark)** (b) Use the Punnet square to show that there is a fifty percent chance that fertilization will lead to male baby and fifty percent chance that it will lead to a female baby.
(3 marks)
6. (a) Write the dental formula of an "adult human being". **(2 marks)**
 (b) Suggest two (2) practices that favour good functioning of the human digestive system. **(2 marks)**
7. Explain how the information about a sharp object injuring the skin reaches the human brain. **(3 marks)**
8. Give at least three functions of a human skeleton. **(3 marks)**
9. Match the following organs of the urinary system to their function by writing the letter of the organ and the letter for the corresponding function: **(4 marks)**
- | <u>Organ:</u> | <u>Function</u> |
|----------------------|--|
| A. Ureter | a) Where urine is produced |
| B. Kidney | b) Urine is stored here |
| C. Urethra | c) Brings urine from the kidneys to the bladder |
| Urinary bladder | d) Urine is eliminated from the body through this tube |

10. (a) Give one location in a seed in which food is stored. **(1 mark)** (b) What type of seed germination is observed in:

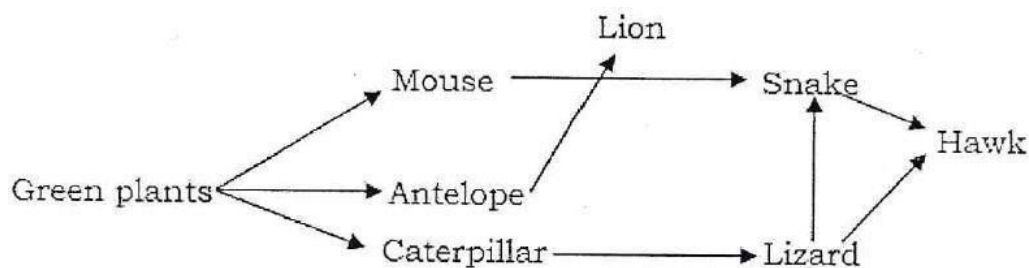
(i) Bean seed? **(1 mark)**

(ii) Pea seed? **(1 mark)**

- (c) Differentiate the two types of seed germination you have in (b) (i) and (b) (ii) above. **(2 marks)**

11. Water has many functions in the human body. State three of these functions. **(3 marks)**

12. Study the following food web



(a) Give a name of one secondary consumer. **(1 mark)**

(b) What would happen if the lions were attacked by a strange disease and died in large number? **(2 marks)**

13. (a) In human males, sperm cells are suspended in a fluid medium. What is the main advantage gained from suspending the sperm cells in fluid medium? **(1 mark)**

(b) Name the structure that serves as the exchange surface for nutrients, wastes and oxygen between the mother and foetus in human females?

(1 mark)

(c) Match the following terms with their functions by writing the Roman number of the term and the letter for the corresponding function:

(4 marks)

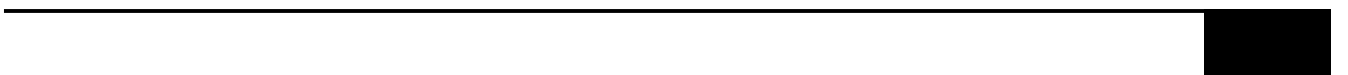
Terms

Functions

- | | |
|------------|---|
| I. Oviduct | A. is an adaptation for internal fertilization. |
| II. Penis | B. is the site for internal fertilization. |
| III. Ovary | C. produces testosterone |
| IV. Testes | D. produces oestrogen and progesterone |

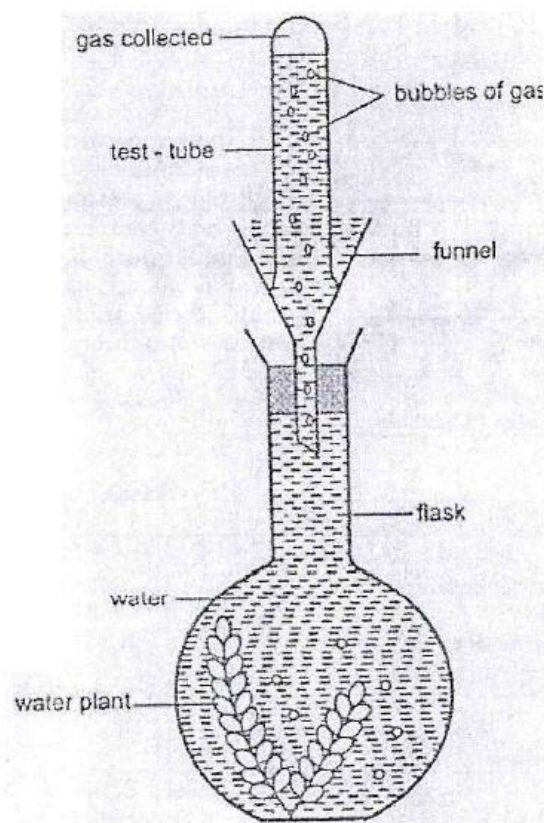
SECTION B: ATTEMPT ANY THREE QUESTIONS (30 MARKS)

14. (a) State the term used to describe the genetic condition in an organism whose cell nuclei contain pair of identical alleles. **(2 marks)** (b) A farmer has cattle in which the polled (P) condition (absence of horns) is dominant to the horned (p) condition. A heterozygous polled bull was crossed with a homozygous horned cow.
- (i) What is the genotype of the parents? **(1 mark)**
 - (ii) What are the possible gametes that can be produced by the parents? **(2 marks)**
 - (iii) Find the possible genotypes and phenotypes of the calves that may result from this cross. **(5 marks)**
15. (a) How can you identify living things (organisms)? **(6 marks)** (b) Micro-organisms are useful and harmful to man. Explain this statement with examples. **(4 marks)**
16. (a) What is an antigen? **(1 mark)**
(b) There are four (4) blood groups: **A, AB, B** and **O**. From these blood groups, show the possible blood compatibility for transfusion. **(9 marks)**
17. (a) Explain how algae reduces the pollution in aquatic (water) areas. **(2 marks)**
(b) State at least two harmful effects of algae. **(2 marks)**
(c) Show how the following non-flowering plants are important:
- (i) Fungi **(3 marks)**
 - (ii) Pteridophytes **(3 marks)**
18. (a) Describe one method that can be used to prevent sexual transmission of HIV/aids. **(2 marks)**
(b) Give three (3) ways in which a woman who has HIV can pass the virus to her baby. **(3 marks)**
(c) Mention at least five (5) categories of people who are at risk of getting HIV. **(5 marks)**



SECTION C: THIS QUESTION IS COMPULSORY (15 marks)

19. Students carried out an experiment below to investigate how a gas is given out during a biological process.



- (a) Give the name of the gas that is collected in the test-tube? **(2 marks)**
(b) Where does the gas in 19 (a) above come from? **(2 marks)**
(c) During which process is the gas in 19 (a) above produced? **(2 marks)**
(d) Write four conditions under which the mentioned gas in 19 (a) is produced? **(4 marks)**
(e) What will happen if the apparatus used is kept in a dark place? **(2 marks)**
(f) Explain why the process given in 19 (c) above may be reduced if there is a deficiency in magnesium ions? **(3 marks)**

**MARKING SCHEME OF ORDINARY LEVEL BIOLOGY
NATIONAL EXAMINATION 2017**

Section A: Answer all questions

1.

- a) Carbon dioxide, water, sunlight energy and chlorophyll. b)

- *Plants are the main sources of food for animals and humans.*
- *Animals, such as birds depend on plants for shelter.*
- *Plants need animals such as insects for pollination.*

2.

- a) *Venae cava (inferior and superior)*
- b) *Pulmonary artery*
- c) *Pulmonary veins*
- d) *The aorta*

Organisms	Kingdom
<i>Bacteria</i>	<i>Monera</i>
<i>Amoeba</i>	<i>Protista</i>
<i>Mushrooms</i>	<i>Fungi</i>
<i>Beans</i>	<i>Plantae</i>
<i>Man</i>	<i>Animalia</i>

4.

- a)
 - i. *Cold-blooded animals (or poikilothermic or ectothermic): body temperature changes according to the surrounding temperature.*
 - ii. *Warm- blooded animals (or homeothermic or endothermic): body temperature remains constant and does not change with surrounding temperature.*
- b)
 - i. *Cold-blooded animals: reptiles, fishes and amphibians.*
 - ii. *Warm-blooded animals: mammals and birds.*

5.

- a)
 - i. *XY*
 - ii. *XX*
- b)
 - Male: XY Female: XX*
 - Gametes: X and Y Gametes: X*

Punnet square

♀ \ ♂	X	Y
X	XX	XY
X	XX	XY

50 % are male babies and 50 % are female babies.

6.

a) Human dental formula: $\frac{2}{2}I + \frac{1}{1}C + \frac{2}{2}PM + \frac{3}{3}M$

b)

- Avoid tooth decay by brushing teeth after each meal
- Avoid breaking hard objects with teeth
- Avoid food poisoning (Ex: Botulism bacteria, Salmonella bacteria, etc.)
- Wash hands before each meal
- Eat at regular times to activate the gastric secretions and prevent gastric ulcers.
- Avoid excess eating
- Chew food well
- Eat slowly, soberly at regular times
- Drink little during meals
- Avoid excessive alcohols, tobacco and spices.....

7. The information about the sharp object is received by a receptor.

Receptors are cells or organs specialized to detect changes in the body and its external environment. The information from the receptor is transmitted to the sensory neuron. The **sensory neuron** carry the information to the human brain where it is analyzed.

8. Functions of the skeleton

- Structural Support of the Body
- Protection of Internal Organs
- Attachment of the Muscles
- Movement of the Body
- Production of Blood Cells
- Storage of Minerals...

9.

Ureter: brings urine from the kidneys to the bladder. (or $A \rightarrow c$)

Kidney: where urine is produced (or $B \rightarrow a$)

Urethra: urine is eliminated from the body through this tube (or $C \rightarrow d$)

Urinary bladder: urine is stored here. (or $D \rightarrow b$)

10.

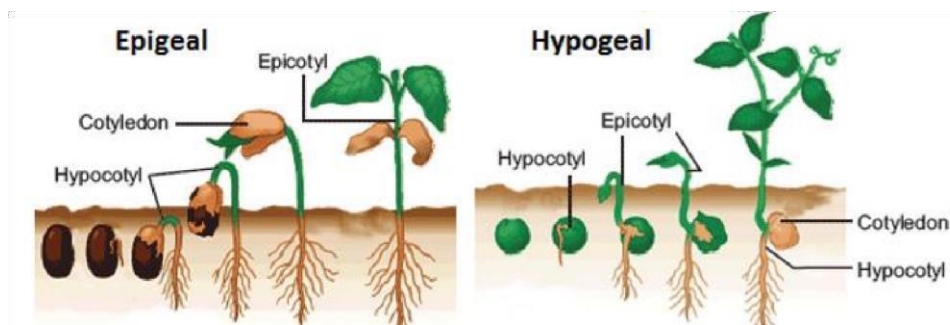
a) Endosperm. Dicot seeds store their food in cotyledons. b)

i. Epigeal germination

ii. Hypogeal germination

c) In epigeal germination, the cotyledons are brought above the ground due to the elongation of hypocotyl. This type of germination is seen in many dicotyledons like bean...

In hypogeal germination, the cotyledons remain in the soil due to the elongation of epicotyl. This type of germination is seen in many dicotyledons like pea and in monocotyledons like maize and wheat.



11. Functions of water

- Transport of substances
- Temperature regulation
- Solvent and medium for reactions • Support for aquatic organisms.
- Reagent (reactant) in hydrolysis reactions.
- Fertilization
- Dispersal of seeds...

12.

- a) Lion or snake or lizard
- b) The number of antelopes would increase; the number of plants would decrease.

13.

- a) The fluid provides nutrients to the sperm. The fluid also helps to neutralize the acidic environment of the vagina.
- b) The placenta
- c)

Oviduct: is the site of internal fertilization. (or I → B)

Penis: is an adaptation for an internal fertilization. (or II → A)

Ovary: produces progesterone and oestrogen (or III → D)

Testes: produces testosterone. (or IV → C)

SECTION B

14.

- a) Homozygous
- b)

i. Pp and pp. ii. Gametes: P and p for one parent and p for the other parent.

♂ ♀	P	p
p	Pp	pp
p	Pp	pp

Genotypes: 50 % Pp and 50 % pp.

Phenotypes: 50 % polled cattle (without horns) and 50 % horned cattle.

15.

a) All living organisms are classified into groups based on very basic, shared characteristics. Organisms within each group are then further divided into smaller groups. These smaller groups are based on more detailed similarities within each larger group. This grouping system makes it easier for scientists to study certain groups of organisms. Characteristics such as **appearance**, **reproduction**, **mobility**, and **functionality** are just a few ways in which living organisms are grouped together. These specialized groups are collectively called the classification of living things. The classification of living things includes 7 levels: **kingdom**, **phylum**, **classes**, **order**, **families**, **genus**, and **species** .

Listed here are the six rules used by scientists to identify living things:

- Living things are made of cells.
- Living things obtain and use energy.
- Living things grow and develop.
- Living things reproduce.
- Living things respond to their environment.
- Living things adapt to their environment

b) Usefulness of microbes:

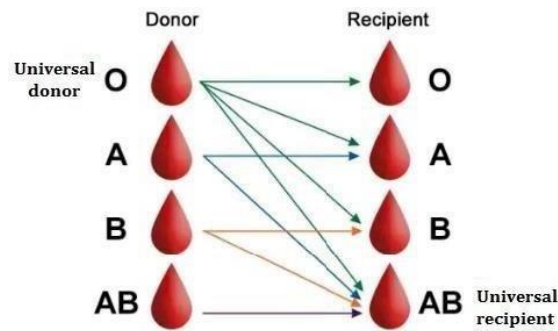
- Recycling of matter
- Many bacteria are able to fix carbon dioxide and create organic compounds.
- Fixation of atmospheric nitrogen
- Production of beer
- Production of bread
- Production of vitamins
- Help in digestion such as in ruminants **Harmful**

effects of microbes:

- Cause diseases
- Cause the spoilage of food
- Denitrifying bacteria reduce fertility of soil
- Some microbes cause food poisoning 16.

a)An antigen is a substance that stimulates the production of an antibody.

b)Blood compatibility for transfusion



17.

a)

- *Algae have become significant organisms for biological purification of wastewater since they are able to accumulate plant nutrients, heavy metals, pesticides, organic and inorganic toxic substances and radioactive matters in their cells/bodies.*
- *Algae are also able to accumulate highly toxic substances such as selenium, zinc and arsenic in their cells and/or bodies thus eliminating such substances from aquatic environments.*
- *Many algae can take up and accumulate many radioactive minerals in their cells even from greater concentrations in the water.* b)
- *Algae can cause eutrophication if there are too much nutrients in a body of water.*
- *Algae can cause contamination of water*
- *Some algae release toxins in the environment that can kill people and animals. Ex: some red algae*
- *Algal blooms may deplete oxygen concentrations in water and smother fish and plant life, as well as prevent light penetration for algae at lower depths, preventing photosynthesis.* c)

Importance of fungi:

- *Fungi can be eaten ex: mushrooms*
- *Production of cheese*
- *Production of wine*
- *Production of beer*

- Production of yoghurt
- Production of antibiotics (example: penicillin)

Importance of ferns:

- Some ferns are used as food
- Ferns are used in decoration
- Some ferns are used as a source of medicine
- Ferns are able to remove chemical pollutants from the atmosphere.

18.

- a) Abstinence or the use of condoms.
 b) Through blood during childbirth (during the cutting of the umbilical cord) The virus can pass through the placenta during pregnancy

The virus can pass in breast milk (during breastfeeding) c)

People with tuberculosis

People with many sexual partners

Adolescents

Homosexuals

Sex workers

People who inject drugs

SECTION C: COMPULSORY QUESTION

19.

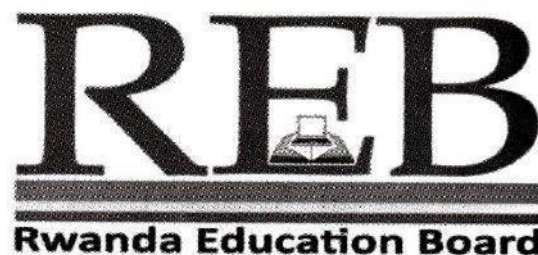
- a) Oxygen
 b) From the photolysis of water.
 c) In the process of photosynthesis.
 d) Presence of water, carbon dioxide, sunlight and chlorophyll.
 e) The production of oxygen will stop. Or the process of photosynthesis will stop.
 f) Magnesium is involved in the production of chlorophyll. Without magnesium, chlorophyll cannot be synthesized.

Chlorophyll is necessary for the process of photosynthesis to take place.

**BIOLOGY AND HEALTH
SCIENCES I**

001

27/11/2018 08.30 AM – 11.30 AM



ORDINARY LEVEL NATIONAL EXAMINATIONS, 2018

SUBJECT: BIOLOGY AND HEALTH SCIENCES

DURATION: 3 HOURS

INSTRUCTIONS:

1. Write your names and index number on the answer booklet as they appear 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 paper until you are told to do so.
3. This paper consists of **three** sections **A**, **B** and **C**

□ Answer **ALL** questions in section A. **(55 marks)**

□ Answer **THREE** questions in section B. **(30 marks)**

□ Answer only **one** question in section C **(15 marks)**

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

SECTION A: Attempt all questions from this section. (55 marks)

1. If a nucleus measures 100 mm on a diagram, with a magnification of $\times 10\,000$. What is the actual size of the nucleus? **(2 marks)**
2. How are root hair cells specialized for their role? **(2 marks)**
3. Match the following cell organelles with their appropriate functions. The first one has been done for you. **(5 marks)**

Organelles	Functions
(A) Nucleus	(i) Where lipids, including steroids are made.
(B) Mitochondrion	(ii) Controls entry of substances into cell.
(C) Plasma membrane	(iii) Controls the activities of the cell.
(D) Chloroplasts	(iv) Where polypeptides (proteins) are made.
(E) Smooth Endoplasmic reticulum	(v) Where photosynthesis takes place.
(F) Ribosome	(vi) Where aerobic respiration takes place.

(A) ↔ (iii) Example

(B) ↔ (vi)

(C) ↔ (ii)

(D) ↔ (v)

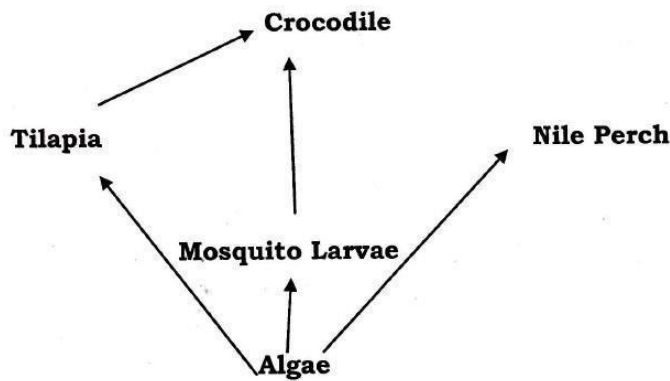
(E) ↔ (i)

(F) ↔ (iv)

4. What is the importance of Predator-Prey relationship? **(1 mark)**
5. Explain how the structure of Arteries, Veins and Capillaries enable them to carry out their functions. **(4 marks)**
6. (a) In the Food Hygiene regulation of 1990, it is stated that cooked meat products must be stored at a temperature below 8°C. Explain how this will help to reduce food poisoning. **(3 marks)**
 (b) Cooked food such as meat pies, which are being kept warm ready to eat, must be stored at temperatures above 63°C. Explain how this helps to reduce food poisoning. **(3 marks)**
7. Experiment on photosynthesis may involve the following:
 (a) Variegated leaves
 (b) Sodium hydroxide
 (c) Ethanol
 (d) Iodine
 (e) Starch
 (f) Oxygen
 Which would you use to:
 (i) Prevent leaves getting CO₂? **(1 mark)** (ii) Remove chlorophyll from leaves? **(1 mark)**
 (iii) Test whether chlorophyll is essential for photosynthesis? **(1 mark)**
 (iv) Test decolorized leaf for starch? **(1 mark)**
8. The table shown below gives the names of certain structures which connect one organ of the human body with another. Complete the right hand column of the table to show two organs which are connected by each structure. The first one has been done for you. **(6 marks)**

Structures	Organs connected by this structure
Bronchus	<u>Trachea</u> with <u>Lungs</u>
Bile duct	 with
Ureter	 with
Optic nerve	 with

9. The figure below shows an example of a food web.



What would happen if the Nile Perch were removed from the food web?
(2 marks)

10. A man with blood group B marries a woman with blood group A. What percentage of offspring will have blood group O?

Show your working. (4 marks)

11. Match the following organisms using an arrow with the structures for gaseous exchange. (5 marks)

A. Earthworm

B. Amoeba

C. Insects

D. Mammal

E. Fish

F. Frog

i) Tracheoles

ii) Alveoli

iii) Gill lamellae

iv) Cell membrane

v) Skin capillaries

12. Which of the following terms (i) to (v) would you associate with:

(a) Asexual reproduction?

(b) Sexual reproduction? **Terms:**

(i) Meiosis

(ii) Identical offspring

(iii) Spores

(iv) Flowers

(v) A variety of offspring

(4 marks)

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

(b) List at least one disease caused by each of the following:
(4marks)

(i) Virus

(ii) Bacteria

(iii) Fungi

(iv) Protocista

14. Explain the difference between Natural selection and Artificial selection. **(4marks)**

SECTION B: ATTEMPT ANY THREE QUESTIONS (30 Marks)

15. (a) Define "transpiration". **(2 marks)**
(b) How do plants benefit from transpiration? **(8 marks)**
16. (a) Define the term "photosynthesis". **(2 marks)**
(b) Describe the conditions necessary for photosynthesis. **(8 marks)**
17. (a) What are major characteristics of enzymes? **(5 marks)**
(a) Imagine if your stomach pH was 7 instead of the normal pH of 2; what would happen? **(5 marks)**
18. Many organisms are able to reproduce asexually and sexually. Suggest the advantages of each process. **(10 marks)**
19. Write short notes on the following biological terms:
(a) Variation. **(4 marks)**
(b) Mutations. **(4 marks)**
(c) Adaptive features. **(2 marks)**

SECTION C: THIS SECTION IS COMPULSORY (15 Marks)

20. In the tables below, indicate how you carry out tests for reducing sugars and non-reducing sugars by filling in the procedure, expected observations and your logical conclusion.

(a) Test for reducing Sugars

Procedure	Observation	Conclusion
(i)		
(ii)		
(iii)		
(iv)		

(b) Test for non-reducing Sugars

Procedure	Observation	Conclusion
(i)		
(ii)		
(iii)		
(iv)		
(v)		
(vi)		

MARKING SCHEME OF ORDINARY LEVEL BIOLOGY NATIONAL EXAMINATION 2018

SECTION A: Answer all questions

1. Magnification = $\frac{\text{size of image}}{\text{size of object (Actual size)}}$

$$\text{Actual size} = \frac{\text{size of image}}{\text{Magnification}} = \frac{100 \text{ mm}}{10000} = 0.01 \text{ mm} = 10 \text{ } \mu\text{m}$$

2. Adaptations of the root hairs for their functions

- Root hairs have hair like projections which increase their surface area.
- Root hairs have many mitochondria which provide the energy for the active transport of substances.
- Root hairs have many aquaporins which increase the absorption of water by osmosis.

3.

(A) ↔ (iii)

Examp
le

(B) ↔ (vi)

(C) ↔ (ii)

(D) ↔ (v)

(E) ↔ (i)

(F) ↔

(iv)

4. *Predator-prey relationship are an important biotic factor for both **predator** and **prey** populations. For example, if there are more prey available, predator numbers can increase since there is more available food. However, as predator numbers increase, prey numbers will tend to decrease because more of them are eaten. Then as prey numbers decrease, predator numbers decrease because there is less available food. As you might have guessed, when predator numbers decrease, prey numbers increase because fewer of them are being eaten.*

5.

- *Arteries have a thick layer of smooth muscle to withstand the high pressure of blood*
- *Arteries have a narrow lumen to allow blood to circulate under high pressure*
- *Veins have a thin layer of smooth muscle as blood moves under low pressure*
- *Veins have a wide lumen since they have a high blood volume*
- *Capillaries have no smooth muscle since blood is at very low pressure*
- *Capillaries are one layer thick to allow the exchange of substances with the body tissues*
- *Capillaries have a very narrow lumen*

6.

- a) Food-poisoning bacteria grow and multiply fastest in the temperature danger zone between 5 °C and 60 °C. It is important to keep high-risk food out of this temperature zone. Cooked meat products must be stored at a temperature below 8 Celsius degrees to prevent the growth of microorganisms which can cause food poisoning. Refrigeration slows down bacterial growth and this is why high-risk perishable foods are kept refrigerated and this helps reduce food poisoning.
- b) Hot foods must be stored above 63 degrees Celsius to prevent the excessive growth of bacteria. Hot foods can be kept below this temperature for a maximum of two hours before being used, returned to above 63 degrees Celsius or chilled.

7.

- a) Sodium hydroxide
b) Ethanol
c) Variegated leaves
d) Iodine 8.

Structures	Organs connected by this structure
Bronchus	<u>Trachea with lung</u>
Bile duct	Liver with small intestines
Ureter	Kidney with urinary bladder
Optic nerve	Eyes with brain
Eustachian tube	Ear with pharynx

9. If the Nile perch were removed from the food web:

- The algae would increase
- The mosquito larvae would increase
- The tilapia also would increase

10.

Genotype of the man:
BO Genotype of the
woman: AO Punnet
square:

♂ ♀	B	O
A	AB	AO
O	BO	OO

The percentage of offspring with blood group O is 25 %.

11.

- A. Earthworm → (v) Skin capillaries
- B. Amoeba → (iv) Cell membrane
- C. Insects → (i) Tracheoles
- D. Mammal → (ii) Alveoli
- E. Fish → (iii) Gill lamellae
- F. Frog → (ii) Alveoli (also they can use skin capillaries)

12.

- a) Asexual reproduction: identical offspring, spores
- b) Sexual reproduction: Meiosis, flowers, variety of offspring

13.

- a) **Parasite:** an organism that lives on or in another organism, deriving benefit from living on or in that other organism, while not contributing towards that other organism sufficiently to cover the cost to that other organism. Lice, fleas, ticks and mites are widely spread parasites. A **pathogen** is any organism or substance, especially a microorganism, capable of causing disease, such as bacteria, viruses, protozoa or fungi.

- b) **Diseases caused by the following:**

- i. Virus: AIDS, ebola, measles, mumps, TBM, influenza (flu)
- ii. Bacteria: tetanus, cholera, tuberculosis, gonorrhoea...
- iii. Fungi: candidiasis, ringworms, **athlete's foot**...
- iv. Protoctista: trichomoniasis, malaria, sleeping sickness...

14. **Natural selection** is a natural process resulting in the evolution of organisms best adapted to the environment. It also called **survival of**

the fittest. **Artificial selection** is selective breeding that occurs when humans instead of environmental forces select and determine the desirable alleles of plants or animals to be passed on to successive generations. Artificial selection has been practiced by humans for several centuries. It has played an important role in the evolution of modern crop plants, farm animals and domestic pets from the wild ancestors.

Section B: Answer only 3 questions

15.

a) Transpiration is the loss of water through the surface of the plant in gaseous state. Transpiration occurs mainly in the stomata.

b) Importance of transpiration

i. **Transport of water:** due to transpiration pull, water is raised and rapidly distributed to all parts of the plants, where it performs various functions of the plant. ii. **Cooling of the plant:** the heat which is generated within the plant during cell respiration and that which the plant receives directly from the sun (solar radiation) would cause the plant to reach high temperatures, thereby denaturing enzymes and killing the plant.

iii. **Distribution of minerals:** The movement of water and ions in the xylem vessels also brings about the distribution of mineral ions to all parts of the plant, especially to meristems where rapid growth takes place. iv. Transpiration helps in the **exchange of gases**

16.

a) Photosynthesis is a metabolic process by which green plants and other autotrophic organisms make (synthesize) sugar (carbohydrates) from carbon dioxide (CO₂) and water, using sunlight energy absorbed by chlorophyll.

b) Requirements for Photosynthesis: photosynthesis requires chlorophyll, carbon dioxide, water and sunlight.

i. **Chlorophyll:** Chlorophylls are green pigments found in all photosynthetic organisms and are responsible for their green colour. In plants, chlorophyll is mainly found in the

leaves. Young stems and fruits may also have chlorophyll. In lower plants like algae, the whole plant is green and takes part in photosynthesis.

- ii. **Carbon dioxide:** Air contains about 0.03% of carbon dioxide. Terrestrial plants use atmospheric carbon dioxide in photosynthesis. Aquatic plants use the carbon dioxide dissolved in water. Plants obtain carbon dioxide through pores called stomata present on the surfaces of leaves. The opening and closing of these pores are regulated by guard cells, which surround them.
- iii. **Water:** Water is an important raw material for photosynthesis. Plants absorb water from the soil through their root hairs. The water is then transported up to the leaves through the stem in the xylem.
- iv. **Sunlight:** Light energy is used in splitting water molecules into hydrogen and oxygen. The splitting of water in the presence of light is called photolysis.

17.

a) Characteristics of enzymes

- i. **Enzymes are not destroyed by the reaction** they catalyze and so can be used again.
- ii. **Enzymes are inactivated (denatured) by excessive heat.** This property of enzymes relates to the fact that they are proteins. The proteins (and therefore enzymes) are denatured at high temperatures. Few cells can tolerate temperatures higher than approximately 45°C.
- iii. **Enzymes are sensitive to PH.** Every enzyme has its own range of PH in which it functions most efficiently. Most intracellular enzymes function best at or around neutral. Excessive acidity or alkalinity renders them inactive. **Enzymes possess active sites where the reaction takes place.** These sites have specific shapes.
- iv. **All enzymes are globular proteins.**
- v. **Enzymes are specific** in the reaction they catalyze. Normally, a given enzyme will catalyze only one reaction or type of reaction. However, the degree of specificity

varies from one enzyme to another. vi. **Enzymes lower the activation energy of reactions they catalyze.** The activation energy is the energy necessary for a reaction to get started.

b) If the stomach pH was 7 instead of the normal pH of 2, the enzymes of the stomach would be denatured. This means that there is a change in their three dimensional shape which makes them unable to perform their functions. This is because when an enzyme becomes denatured the active site is modified so that the substrate becomes unable to fit into it.

18.

Advantages of asexual reproduction

- It produces relatively more offspring than sexual reproduction. This facilitates faster propagation of the species.
- Large numbers of organisms mean that species may survive when conditions or the number of predators change.
- Energy is not required to find a mate because it requires only one parent.
- It results in the maintenance of favourable characters because the offspring are genetically identical.
- It does not depend on external agents like pollinators, dispersal agents in plants and mates in animals, because every species is self-sufficient.
- It facilitates the establishment of polyploids particularly those with odd numbers of sets of chromosomes.

The advantages of sexual reproduction

- ✓ The biggest advantage of sexual reproduction is that it allows for diversity among the offspring (**genetic variation**). If all organisms are not exactly alike, then they might have little variations that help them survive when the environment changes. So variation is a survival mechanism.

- ✓ It produces **relatively fewer offspring** than in asexual reproduction and it does not normally result in overcrowding around the parent.

19.

a) **Variations:** Variation is any difference between cells, individual organisms, or groups of organisms of any species caused either by genetic differences (**genotypic variation**) or by the effect of environmental factors on the expression of the genetic potentials (**phenotypic variation**). Some of the features of the different organisms in a species show continuous variation, and some features show discontinuous variation. In **continuous variation**, there is a wide range of phenotypes (no distinct categories) whereas in **discontinuous variation** the individuals are grouped in distinct categories without intermediates.

Variation is caused by the following factors: crossing over, mutation, random fusion of gametes, independent assortment of chromosomes and environmental factors such as diet, exposure to light, climate and pH.

b) **Mutations:** A mutation is a change that occurs in our DNA sequence, either due to mistakes when the DNA is copied or as the result of environmental factors such as UV light and cigarette smoke. Mutations range in size; they can affect anywhere from a single DNA base pair (**gene mutation**) to a large segment of a chromosome that includes multiple genes (**chromosomal mutation**).

While mutations can occur spontaneously, some can be caused by exposure to physical or chemical agents in the environment called **mutagens**. Common environmental mutagens include ultraviolet rays from the sun and various chemicals, such as asbestos, cigarette smoke, and nitrous acid and high-energy radiation, such as medical X rays.

Mutations can be **harmful or beneficial**. Harmful mutations can cause **genetic disorders and cancers** whereas beneficial mutations lead to the **survival of the individual best fit to the current environment**, which results in evolution.

c) **Adaptive features:** The adaptive features may be structural, behavioural or physiological responsive adjustments to varying conditions. An adaptation is any feature observed in an organism that helps it to survive in a given environment. Adaptation is the accommodation of a living organism to its environment. One form of adaptation, called **physiological adaptation**, involves the acclimatization of an individual organism to a sudden change in environment.

Structural adaptations are physical features of an organism, such as shape, body covering, armament, and internal organization Adaptation affects all aspects of the life of an organism.

Behavioural adaptations are adaptations which are observed in animals and are due to the way an animal behaves in a given situation.

SECTION C: COMPULSORY QUESTION

20.

a) Test for reducing sugars

Procedure	Observations	Conclusion
(i) Dissolve in water the substance to be tested	The solution is colourless	
(ii) Take 1cm ³ of test solution	The solution is colourless	
(iii) Add 1 cm ³ of Benedict's solution	The solution becomes blue	
(iv) Boil	The solution changes from blue to green, yellow, orange and finally red brown precipitate	The solution contains reducing sugars

b) Test for non-reducing sugars

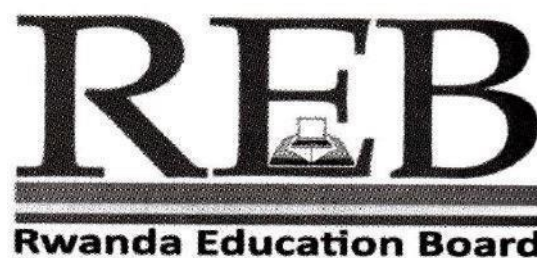
Procedure	Observations	Conclusion
(i) Take 1cm ³ of test solution	The solution is colourless	
(ii) Add 1 cm ³ of Benedict's solution	The solution remains blue	
(iii) Boil	The solution remains blue	The solution does not contain reducing sugars
(iv) Take 1cm ³ of test solution, add 1cm ³ of HCl and boil for 5 minutes.	The solution remains blue	

(v) Cool the mixture, add 1cm ³ of dilute NaOH solution followed by 1cm ³ of Benedict's solution	The solution remains blue	
(vi) Boil	The solution changes from blue to green, yellow, orange and finally red brown precipitate	The solution contain non-reducing sugars

**BIOLOGY AND HEALTH
SCIENCES I**

001

19/11/2019 08.30 AM – 11.30 AM



ORDINARY LEVEL NATIONAL EXAMINATIONS, 2019

SUBJECT: BIOLOGY AND HEALTH SCIENCES

DURATION: 3 HOURS

INSTRUCTIONS:

1. Write your names and index number on the answer booklet as they appear 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 paper until you are told to do so.
3. This paper consists of **three** sections **A**, **B** and **C**

- ☐ Answer **ALL** questions in section A. **(55 marks)**
- ☐ Answer **THREE** questions in section B. **(30 marks)**
- ☐ Answer only **one** question in section C **(15 marks)**

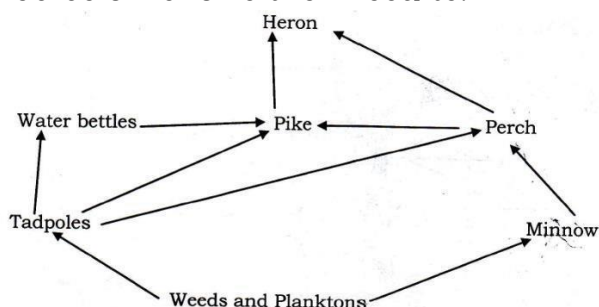
4. Use only a **blue** or **black** pen.

SECTION A: Attempt all questions from this section. **(55 marks)**

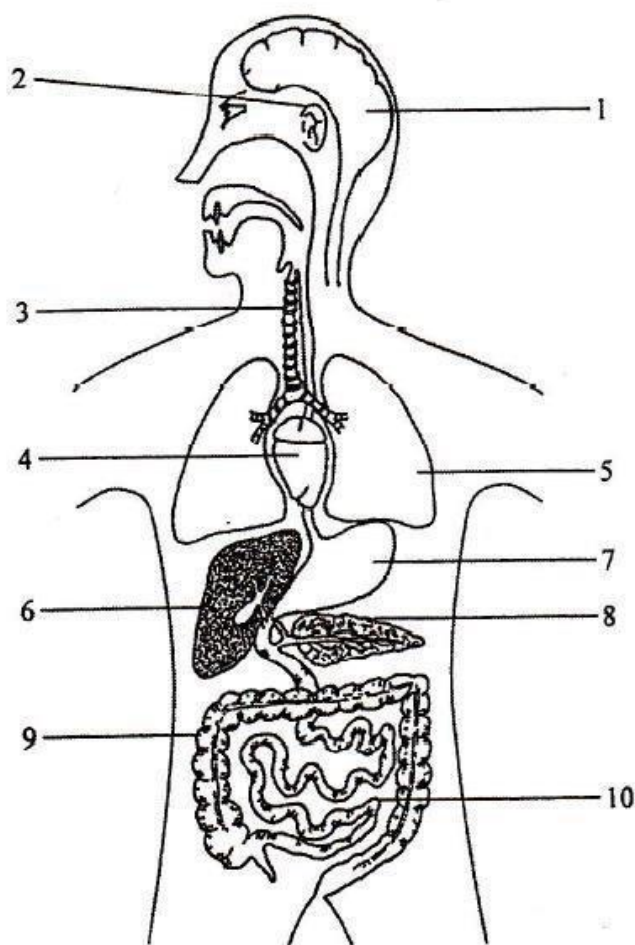
1. Write **T (True)** or **F (False)** against the following statements.
 Anaerobic respiration in the body: a)
 Produces carbon dioxide
 b) Uses glucose
 c) Needs oxygen
 d) Liberates more energy than aerobic respiration
 e) Takes place in the Mitochondria. **(5 marks)**
2. Suggest why it is difficult to decide whether viruses are living Organisms. **(4 marks)**
3. Green plants make their own food by photosynthesis.
 - a) What are raw materials of photosynthesis? **(2 marks)**
 - b) What gas is given off during photosynthesis? **(1 mark)**
 - c) What sugar is produced by photosynthesis? **(1 mark)**
 - d) Where does energy come from to make photosynthesis work? **(1 mark)**
4. From the following environmental factors, select those that are abiotic and those that are biotic
 - a) Sunlight
 - b) Parasites
 - c) Symbionts
 - d) Wind
 - e) Competition
 - f) Mineral salts **(2 marks)**
5. Explain why elimination of water by the kidneys may be considered to be both excretion and osmoregulation. **(2 marks)**
6. Explain how microscopic animals can survive without having a circulatory system. **(3 marks)**

7. If sucrose is tested using Benedict's test for reducing sugars, no change is observed. The bonds between the glucose and fructose must be broken before the test for reducing sugars.
Describe how the bond can be broken chemically. **(2 marks)**

8. A group of students studied the feeding relationship in a pond. The Food Web below shows their results.



- a) What information is given by the arrows in this Food web? **(2 marks)**
- b) A disease killed most of the Minnows. Explain the likely effect of the death of most minnows on the following organisms in the pond:
- i) Perch **(2 marks)** ii) Tadpoles **(2 marks)** iii) Planktons **(2 marks)**
9. The diagram below represents a human body. Some of the organs are numbered: Copy the table below and complete it. The first answer is done for you. **(6 marks)**



Function	Organ number
Helps to control bodily functions	1
Senses both sound and balance	
Acidic part of digestive system	
Stores carbohydrates as glycogen	
Allows absorption of digested food into the blood stream	
Produces digestive enzymes and insulin	
Absorbs water from undigested food	

10. This question is about cell division. Copy the table below and complete it by putting a tick (✓) in the correct column. The first answer is done for you.

(6 marks)

S/N	Feature		
		Meiosis	Mitosis
1	Changes take place in the nucleus	✓	✓
2	Produces gametes		

3	Produces daughter cells with identical chromosomes		
4	Half chromosomes are passed to each daughter cell		
5	Homologous chromosomes are randomly assorted into daughter cells		
6	Mutations can occur to change genetic code		
7	Chromatids are separated by fibres within the cell		

11. Individuals are different. A group of students studied the Variation in the Leaf area of one type of Rose Flowers.
The table below shows their results.

Area in cm ²	3.0 – 5.0	5.0 – 7.0	7.0 – 9.0	9.0 – 11.0	11.0 – 13.0
Frequency	20	65	98	62	17

- a) i) What type of variation is shown by the leaf area? **(1 mark)** ii) Give two possible causes of this variation. **(2 marks)** b) i) What is Mutation? **(1 mark)** ii) Explain how mutations can be caused. **(2 marks)**

12. Certain Mollusca can either be striped or unstriped. The B allele for striped is dominant over the allele of unstriped Mollusca. If Mollusca of genotype Bb is crossed with a homozygous dominant having a striped shell:
a) What would be the ratio of genotypes in the offspring? Show your working. **(2 marks)** b) What is the expected ratio of phenotypes? **(1 mark)**

13. Briefly explain how the flow of blood is maintained in a mammal. **(3 marks)**

SECTION B: Attempt only three questions (30 marks)

14. a) Define the term "health". **(4 marks)**
b) What are the factors that affect good health? **(6 marks)**

15. a) Explain the major differences between Mitosis and Meiosis. **(8 marks)**
b) What is the role of Mitosis? **(2 marks)**

16. Using your knowledge of Biology, suggest how you can eliminate malaria in your District. **(10 marks)**

17. a) What is variation? **(2 marks)**

b) With examples, describe different types of variation. **(8 marks)**

18. Discuss the mechanisms by which blood glucose is controlled in a human. **(10 marks)**

SECTION C: This question is compulsory (15 marks)

19. Assuming that you are provided with a simple leaf of a plant labelled specimen Q;

a) Draw a well labelled biological drawing of specimen Q. **(10 marks)**

b) How is specimen 4 adapted to its functions? **(5 marks)**

**MARKING SCHEME OF ORDINARY LEVEL BIOLOGY
NATIONAL EXAMINATION 2019**

SECTION A: Answer all questions

1.

- a) *True*
- b) *Tue*
- c) *False*
- d) *False*
- e) *False*

2. *Reasons why it is difficult to decide whether viruses are living organisms:*

- *They are noncellular (they are not made of cells);*
- *They cannot metabolize; □ They cannot respond to stimuli; □ They crystallize when in isolation.*
- *They cannot reproduce outside of host.*
- *They cannot reproduce on their own.*
- *They do not grow.*
- *They do not carry out metabolic functions. □ They cannot maintain their homeostasis.*
- *They cannot have both DNA and RNA...*

3.

- a) *Carbon dioxide and water*
- b) *Oxygen*
- c) *Glucose*
- d) *From the sun* 4.

Abiotic factors	Biotic factors
<i>Sun light</i>	<i>Parasites</i>
<i>Wind</i>	<i>Symbionts</i>
<i>Mineral salts</i>	<i>Competition</i>

5. *The elimination of water by the kidneys may be considered to be both excretion and osmoregulation.*

- It is considered as **excretion** because the kidneys help to remove the excess of water from our body (the unwanted water molecules).
 - It is considered as **osmoregulation** because the kidneys help to maintain constant the osmotic pressure of the blood and tissue fluid (control of the concentration of dissolved substances in the cells and body fluids of an animal).
6. Microscopic animals can survive without a transport system because they have **a large surface area to volume ratio of their body**. The process of **diffusion is enough to deliver nutrients and oxygen** to each cell of the animal. The process of diffusion is also enough to **remove the metabolic waste products since these microscopic organisms have a large surface area to volume ratio of their body**.
7. Sucrose can be hydrolysed to its monosaccharide constituents by **boiling it with dilute hydrochloric acid**. Sucrose is hydrolysed to **glucose and fructose**, both of which are reducing sugars and give the reducing sugar result with the Benedict's test. **NaOH is added in order to neutralize HCl because Benedict's solution works best in neutral PH**.
- 8.
- a) Meaning of the arrow: 'is eaten by'
 - b)
 - i. The number of perch would decrease
 - ii. The tadpoles would decrease since more of them will be eaten by
 - iii. theThe perch number as oftheir planktons only food. would increase.

9.

Function	Organ number
Senses both sound and balance	2
Acidic part of digestive system	7
Stores carbohydrates as glycogen	6
Allows absorption of digested food into the blood stream	10

<i>Produces digestive enzymes and insulin</i>	<i>8</i>
<i>Absorbs water from undigested food</i>	<i>9</i>

10.

	Feature		
		Meiosis	Mitosis
<i>1</i>	<i>Changes take place in the nucleus</i>	<i>✓</i>	<i>✓</i>
<i>2</i>	<i>Produces gametes</i>	<i>✓</i>	<i>X</i>
<i>3</i>	<i>Produces daughter cells with identical chromosomes</i>	<i>X</i>	<i>✓</i>
<i>4</i>	<i>Half chromosomes are passed to each daughter cell</i>	<i>✓</i>	<i>X</i>
<i>5</i>	<i>Homologous chromosomes are randomly assorted into daughter cells</i>	<i>✓</i>	<i>X</i>
<i>6</i>	<i>Mutations can occur to change genetic code</i>	<i>✓</i>	<i>✓</i>
<i>7</i>	<i>Chromatids are separated by fibres within the cell</i>	<i>✓</i>	<i>✓</i>

11.

a)

- i. Continuous variation
- ii. Genetic factors and environmental factors

b)

- i. A **mutation** is a **change in the sequence of DNA**. Or a mutation is **a change in the genetic material** of an organism.
- ii. Some mutations can occur **spontaneously**, some can be caused by exposure to **physical** or **chemical agents** in the environment called **mutagens**. Common environmental mutagens include ultraviolet rays from the sun and various chemicals, such as asbestos, cigarette smoke, and nitrous acid. High-energy radiation, such as medical X rays, can cause DNA strands to break, leading to the deletion of potentially important genetic information.

Mutations can also be caused by **errors in the process of cell division** called **nondisjunction**, in which the members of a pair of homologous chromosomes do not move apart properly during meiosis I, or in which sister chromatids fail to separate during meiosis II.

12.

Striped appearance: **B**

Unstriped appearance: **b**

The genotype of one parent: **Bb**

The other parent is **homozygous dominant**. Its genotype is **BB**

Genotypes: **BB** **Bb**
 Gametes: **B, B** **B, b**

Punnet square

♂ ♀	B	B
B	BB	BB
b	Bb	Bb

a) **Ratio of genotypes:** 50 % **BB**; 50 % **Bb**

b) **Ratio of phenotypes:** 100 % with striped appearance

13. Mammals have **a four-chambered heart that completely separates oxygen-rich blood and oxygen-poor blood**. There is no possible mixing between oxygenated and deoxygenated blood. The **heart** is the muscular organ that pumps blood through the blood vessels by repeated, rhythmic contractions. Blood flows through the heart **in two separate loops**.

The right side of the heart collects deoxygenated blood from the body and pumps it into the lungs where it releases carbon dioxide and picks up oxygen. The left-side carries the oxygenated blood back from the lungs, into the left side of the heart which then pumps the oxygenated blood throughout the rest of the body.

Section B: Answer only 3 questions

14.

a) **Health** as a state of complete physical, mental and social well-being and not merely the absence of disease and infirmity. Or

the general condition of the body or mind, especially in terms of the absence of illnesses, injuries or impairments.

b) Factors that affect good health

Food inspection services: Food inspections services help to let you have a complete check of your running production in factories or across the country. An inspector performs a random selection checking on quantity, packing, labelling, dimension, weight and visual aspects.

Need for control of housing conditions: Living conditions affect people's lives, be it at home or the workplace. Without good living conditions, people's health and work will be affected. Nowadays, the quality of housing accompanied with good housing facilities is now improving.

Need for control of clean water: For being healthy, only clean water must be used. Different materials are used to clean water. They include "Sûr-eau", heating or by using water purification etc. The steps of water purification are: storage reservoir, aeration, filtration, disinfection, reduction of chlorine concentration, covered service reservoir, distribution.

Need for control of hygiene: Many diseases can be prevented from having a damaging effect on the body by the action of natural defenses, antibiotics or other medicines. However, there are many steps that can be taken by individuals, and by the community as a whole, to fight microbes even before they enter the body and cause disease. These steps concern personal hygiene (cleanliness) and sanitation (public cleanliness involving community efforts in disease prevention), both of which help to prevent disease.

Personal hygiene

- Hands frequently touch many things which may carry pathogens. They must be always washed using a soap before preparing food, eating and after a visit to a toilet.
- It is essential to bath frequently because sweat and oil secretions on the skin enable bacteria and fungi to breed easily.

This helps to prevent skin infections. – Teeth should be cleaned at least twice a day, preferably after each meal because the spaces between teeth where food particles are trapped provide excellent breeding grounds for bacteria...

Exercise, recreation and rest are other factors that are important in promoting health.

Exercise: exercise makes the muscles strong so that they can support the body better. It helps to get rid of excretory materials and to improve digestion. It quickens blood circulation and improves the action of the glands and nerves. **Recreation:** gardening, playing games and reading can remove any dullness and mental tiredness resulting from everyday work.

Sleeping is the best form of rest: adults need about eight hours of sleep a day. A great deal of repair of worn-out tissues in the body and the building up of new ones takes place when body rests.

15.

a) Differences between mitosis and meiosis

Mitosis	Meiosis
One division completes the process	Two divisions are required to complete the process
One diploid cell produces two diploid cells	One diploid cell produces four haploid cells
Homologous chromosomes do not cross- over	Homologous chromosomes cross- over in prophase I.
Daughter cells have the same genetic information as the parent cell.	Daughter cells are genetically different from the parent cell.
Mitosis generates body cells	Meiosis generates sex cells (gametes)
Mitosis results in growth, the replacement of worn-out cells, and the repair of damage.	Meiosis is necessary for sexual reproduction

b) Importance of mitosis

- **Growth:** The number of cells within an organism increases and this is the basis of growth in multicellular organisms.
- **Cell replacement:** Replacement of cells and tissues also involves mitosis. Cells are constantly dying and being replaced, an obvious example being in the skin.
- **Regeneration:** Some animals are able to regenerate whole parts of the body, such as legs in crustacean and arms in starfish. Production of the new cells involves mitosis.
- **Asexual reproduction:** Mitosis is the basis of asexual reproduction, the production of new individuals of a species by one parent organism. Many species undergo asexual reproduction.

16. Different ways of eliminating malaria in my district

- **Drainage of stagnant water:** The larval stages of the mosquito live in stagnant water, so drainage removes breeding sites. This has had some success.
- **Destruction of the breeding sites of the mosquito:** The larvae and pupae of mosquitoes obtain their oxygen by means of small tubes which are pushed through the water surface film. Thus any method of blocking these tubes will result in the death of the intermediate life stages of the mosquito (petrol, oil....)
- **Destruction of the adult mosquitoes:** This is aimed at killing the mosquitoes that enter houses. Thus, the indoor surfaces are sprayed with a persistent insecticide.
- **By using treated mosquito nets.**
- **By closing the windows at 6 pm.**
- **By using medicines to treat people with malaria.**
- **Sensitizing the population** on the different ways by which malaria can be transmitted.
- **By using biological control.** This can be done by using the fishes that feed on the larvae of anopheles mosquitoes.

17.

a) Variation refers to **the differences in characteristics** between individuals of the **same species**.

b)

Variation can be described as being either **discontinuous** or **continuous**. **Continuous variation:** Human height is an example of continuous variation. Height ranges from that of the shortest person in the world to that of the tallest person. Any height is possible between these values. So it is continuous variation. For any species a characteristic that **changes gradually over a range of values** shows continuous variation. Examples of such characteristics are: height, weight, foot length...

Discontinuous variation: human blood group is an example of discontinuous variation. There are only 4 types of blood group. There are no other possibilities and there are no values in between. So this is discontinuous variation. A characteristic of any species with **only a limited number of possible values** shows discontinuous variation. Here are some examples: gender (male or female) and blood groups (A, B, AB or O).

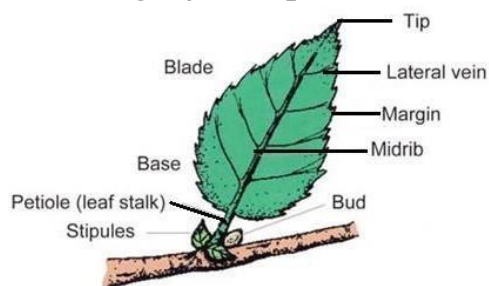
18. The regulation of blood glucose level involves two hormones produced by the pancreas called **insulin** and **glucagon**. Insulin and glucagon are **antagonistic hormones** that regulate the concentration of glucose in the blood. Insulin and glucagon both influence blood glucose concentration by multiple mechanisms. **Insulin lowers blood glucose** levels by stimulating virtually all body cells except those of the brain to take up glucose from the blood. Insulin also decreases blood glucose by **slowing glycogen breakdown in the liver** and **inhibiting the conversion of amino acids and fatty acids to sugars**. The liver, skeletal muscles and adipose tissues store large amounts of fuel molecules and are especially important in the regulation of blood glucose level. The liver and muscles store sugar as glycogen whereas adipose tissue cells convert sugars to fats. The liver is a key fuel processing center because only liver cells are sensitive to glucagon. Normally, glucagon starts having an effect before blood glucose levels even drop below the set point (90mg/100ml). In fact,

as soon as the concentration of glucose exceeds the normal range, **excess glucose is cleared from the blood by the action of insulin**. It is then stored into glycogen. When the level of glucose drops below the set point, **glucagon signals the liver cells to increase glycogen hydrolysis, converts amino acids and fats to sugar and starts slowly releasing glucose back to the circulation**.

SECTION C: COMPULSORY QUESTION

19.

a) Drawing of the specimen Q



b) Adaptations of specimen Q to its functions

- A **large surface area** that collects as much sunlight as possible.
- A **thin lamina** (leaf blade), as most light is absorbed in the first few millimetres of the leaf and the diffusion distance is kept short.
- A **transparent cuticle** and epidermis that let light through to the photosynthetic palisade cells beneath.
- **Numerous stomata** for gaseous exchange that open and close in response to changes in light intensity.
- **Many air spaces**, especially in the **spongy mesophyll**, to allow diffusion of carbon dioxide and water.
- A **network of vascular tissue** made up of **xylem that brings water to the leaf cells** and **phloem that carries away the sugars** produced in photosynthesis.