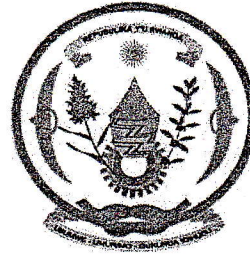


REPUBLIC OF RWANDA



Biology III

002

07th Nov 2008 8.30am-11.30am

**NATIONAL EXAMINATIONS COUNCIL
P.O.BOX 3817 KIGALI**

ORDINARY LEVEL NATIONAL EXAMINATION 2008

SUBJECT : BIOLOGY III

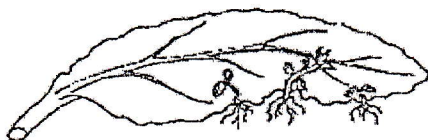
TIME : 3 HOURS

INSTRUCTIONS:

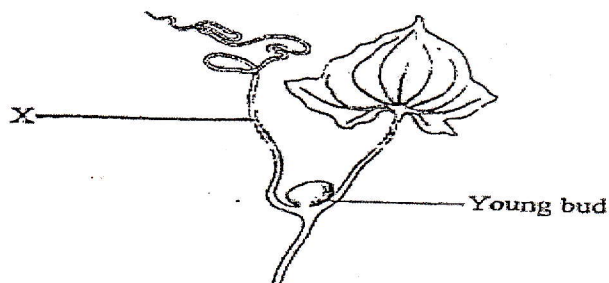
- This paper consists of **THREE** Sections A, B and C.
- Answer **ALL** the questions in section A. **(55 marks)**
- Answer **THREE** questions in section B. **(30 marks)**
- Answer only **ONE** question in section C. **(15 marks)**

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.
(a) Man
(b) Lizard
(c) Fish
(d) Insects. (4 marks)
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)

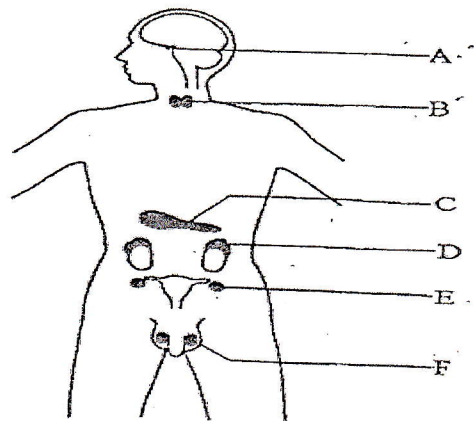
- (b) What is the haploid number of chromosomes in a mouse?
 (c) How many chromosomes would you find in a leaf cell of a pea?

(1 mark)
 (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.
 (b) Suggest ways in which people in your village could reduce the occurrence of malaria carrying mosquitoes in their immediate area.
17. (a) The xylem and phloem of the root are continuous with the xylem and phloem of the stem and leaves. Explain why this continuous system of tubes is necessary for the plant.
 (b) Explain why it is necessary for a root tip to be covered with a protective cap of cells.
18. (a) Describe some of the potential disadvantages of reproducing asexually and advantages of reproducing sexually.
 (b) What is parthenogenesis?
19. The diagram below shows the position of the endocrine glands in humans.

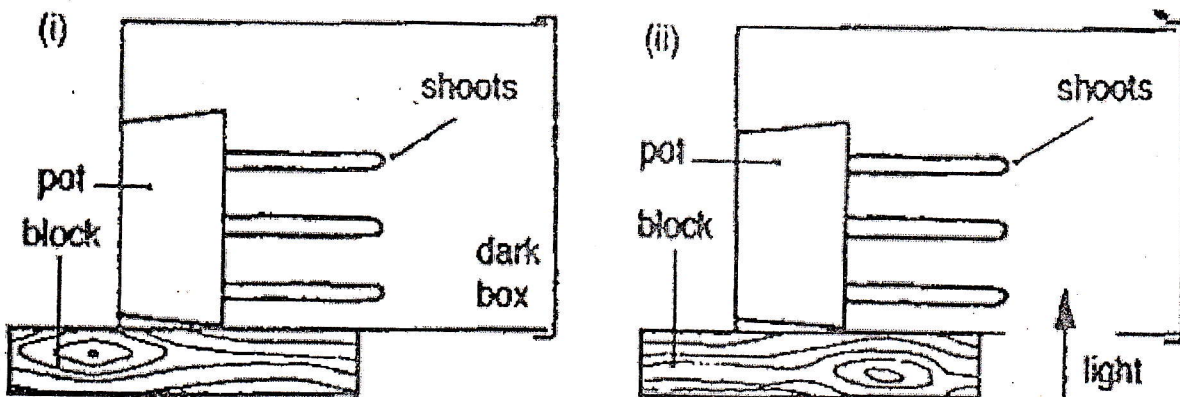
(6 marks)
 (4 marks)
 (7 marks)
 (3 marks)
 (8 marks)
 (2 marks)



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

(6 marks)
 (2 marks)
 (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	1350	- %	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	5000	100%	17800	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)

END.

ANSWERS FOR BIOLOGY III 2008

SECTION A

Answer to Question 1.

- (a) HIV positive: the presence of HIV in the blood.
- (b) Ways of transmitting HIV/AIDS:
 - Blood transfusion, Sharp objects, Vaginal secretions, Across the placenta (through exchange of materials), Mother to child during birth, Through unprotected sex.

Answer to Question 2.

- (a) Babies need a high proportion of proteins because they are food manufacturers and babies are growing.
- (b) For obtaining a large amount of energy needed for muscle activity.

Answer to Question 3.

- (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.

Answer to Question 4.

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

Answer to Question 5.

- a) An eco system 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 which is passed on to higher consumers, they provide food to primary consumers.

Answer to Question 6.

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

Answer to Question 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 rather excreted out of the body as urea.

Answer to Question 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 effective 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 having them land on the stigma.

Answer to Question 9.

- a) Tendril
b) To provide extra mechanical support to the plant.

Answer to Question 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 vaso-constriction in the artery walls. This narrows the lumen thus increasing the pressure and rate at which blood flows.

Answer to Question 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.

Answer to Question 12.

- a) This is meant to minimize water loss through the cuticle.
b) To allow light penetrate to deep layers in order to carryout 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.

Answer to Question 13.

- (a) This is a gradual process of growth in insects that involves changing 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

Answer to Question 14.

- (a) Frequent urinating i.e. always going to the toilet for a short call, Producing dilute 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.

Answer to Question 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

Answer to Question 16.

- (a) AIDS has a greater potential to kill a large population because of the following;
- 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.

Answer to Question 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.

Answer to Question 18.

(a) Disadvantages of asexual reproduction

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

Advantage of sexual reproduction

- It introduces variation among the offsprings..
- It makes the offsprings 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 offsprings from unfertilised eggs. It is common in lower animals e.g. bees

Answer to Question 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

Answer to Question 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 setup (ii) was placed in a black box with an opening for light to enter on the side. Also, both setups 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 set up (ii) the shoots will grow bending downwards in the direction of light.

SECTION C

Answer to Question 21.

(a) Table showing the percentage of total blood flow

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	4%	750	4.2%
Lung tissue	100	2%	200	1.1%
Kidney	1.100	22%	600	3.4%
Liver	1350	27%	600	3.4%
Skeletal Muscle	750	15%	12,500	70.2%
Bone	250	5%	250	1.4%
Skin	300	6%	1900	10.7%
Thyroid gland	50	1%	50	0.3%
Adrenal gland	25	0.5%	25	0.1%
Other tissues	175	3.5%	175	1%
Total	5000	100%	17800	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.

Answer to Question 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 50°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 1cm³ of dilute HCl_(aq), then heat for 1 minute for each. Cool, add 1cm³ of dilute NaOH_(aq) followed by 2cm³ of Benedict's solution and heat for 1 minute. Observe

Observation

Iodine test: Test tube **A** was negative (remained brown) while test tube **B** was positive (turned blue-black).

Non – reducing sugar test: Test tube **A** was positive (i.e. turned blue to green to yellow then brown) while test tube **B** was negative (remained blue).

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.

END.