

Biology I

029

07 Nov. 2008 8.30am-11.30am

RWANDA NATIONAL EXAMINATIONS COUNCIL



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ADVANCED LEVEL NATIONAL EXAMINATION 2008

SUBJECT : BIOLOGY I

OPTION : BIOLOGY-CHEMISTRY

TIME : 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 **ONE** question in section C. (15 marks)

Section A: Answer all questions (55 marks)

1. List the organelles that can be seen with the electron microscope:
 - a) in both animals and plant cells (2marks)
 - b) in plant cells only. (1mark)

2.
 - a) Describe the structure of a lysosome. (2marks)
 - b) Describe the roles of lysosomes. (2marks)

3.
 - a) Describe the role of carrier proteins in active transport. (2marks)
 - b) Explain why the carrier proteins used for facilitated diffusion have a variety of different shapes. (1mark)
 - c) Suggest why the proteins in cell membranes are globular rather than fibrous. (2marks)

4. The table below lists some enzymes associated with carbohydrate digestion in humans, their site of secretion and products of their action. Complete the table by filling in the blank spaces.

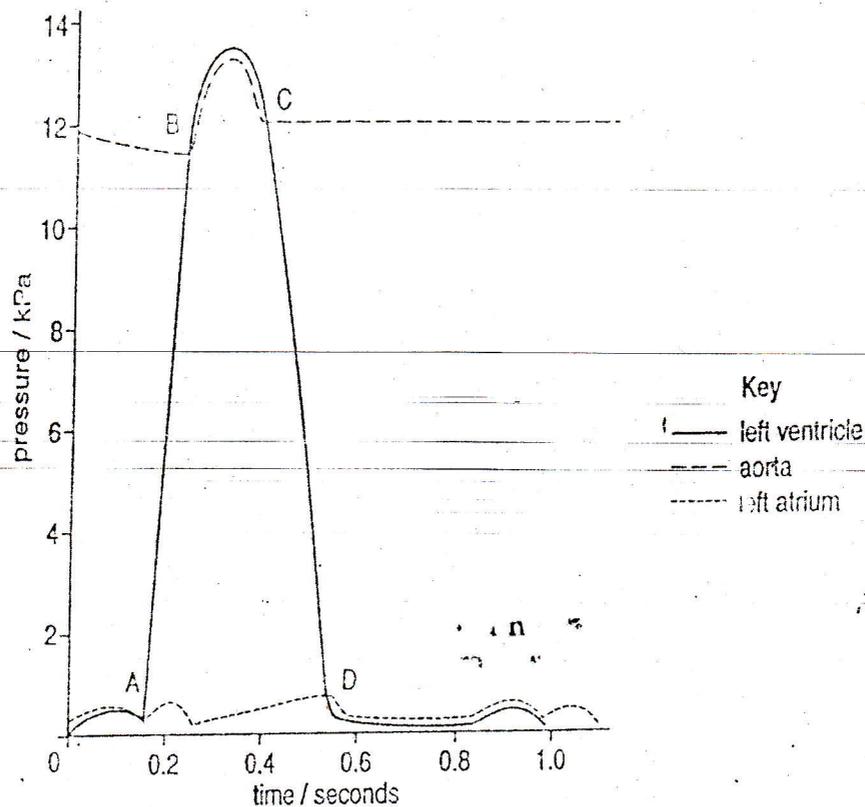
ENZYME	SITE OF SECRETION	PRODUCTS
Amylase
.....	Lining of ileum	Glucose and galactose
Sucrase	Glucose and fructose

5.
 - a) What is the nitrogenous waste product of amoeba? (1mark)
 - b) The amoeba is a single celled organism that lives in water. Describe how it engulfs particles of food by endocytosis. (2marks)

6. Explain why the HIV virus has such devastating effect on our body's ability to fight diseases. (2marks)

7. Distinguish between:
 - a) alpha (α) glucose and beta (β) glucose (2marks)
 - b) glycogen and cellulose. (2marks)

8. a) Which blood vessel carries food away from the intestines to the liver? **(1mark)**
- b) How is food pushed along the small intestines? **(1mark)**
- c) What is the role of colon in a human? **(2marks)**
9. Stomata can open and close. Describe the mechanism which causes changes in ion concentration within the guard cells and explain how this leads to a change in turgidity. **(3marks)**
10. The figure below shows pressure changes to the left side of the heart and the Aorta during the cardiac cycle.

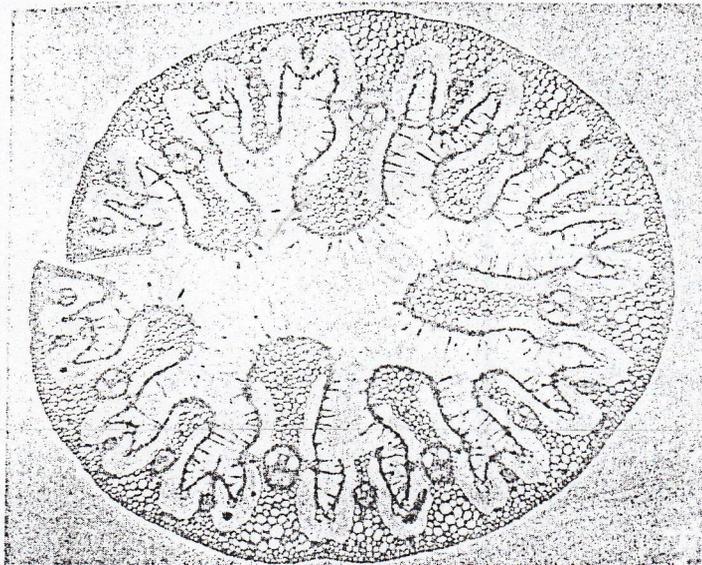


- a) State what is happening at point A-D on the graph. Explain your answer. **(4marks)**
- b) If the time for one complete cardiac cycle is 0.8 seconds, how many cardiac cycles are there in one minute. **(1mark)**

11. The sequence of events in the cardiac cycle needs to be carefully co-ordinated. Describe the role of the sino-atrial node (SAN) and atrioventricular node (AVN) in coordinating the heart beat.

(3marks)

12. The figure below shows a cross section of xerophytic leaf.



Describe THREE features which indicate that this plant lives in a dry climate. For each feature, explain how it helps the plant to survive in this environment.

(6marks)

13. When red flowered petunia plants are crossed with white flowered plants, the resulting F_1 all have pink flowers.

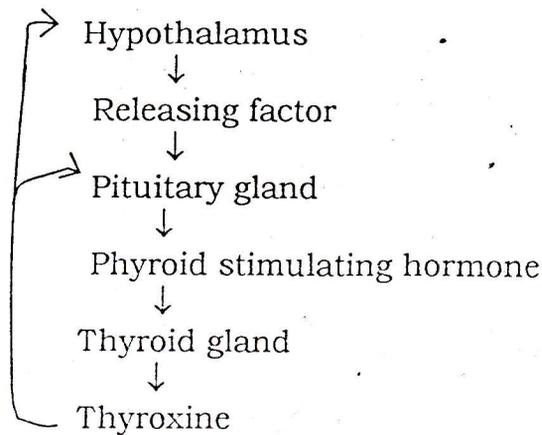
a) Explain how this is possible using genetic diagrams.

(2marks)

b) The F_1 plants are crossed to produce F_2 . Draw a genetic cross to show the genotypes and phenotypes of the F_2 plants.

(3marks)

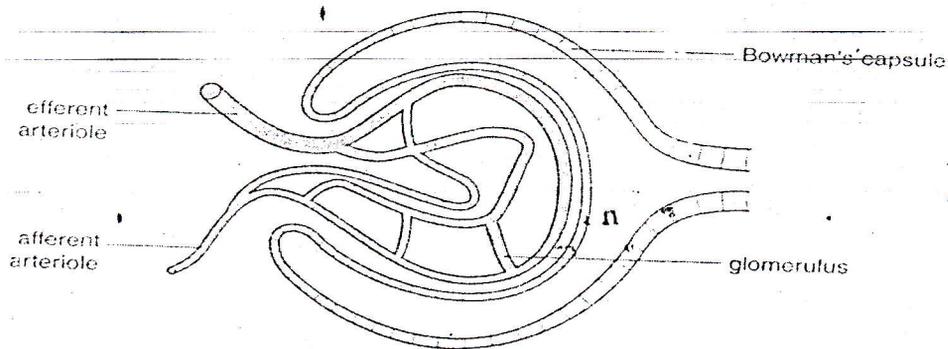
14. All hormones work on a similar principle. The flow chart below shows the sequence of events leading to the production of thyroxine.



- a) How does the level of thyroxine affect the action of the hypothalamus and pituitary gland? (3marks)
- b) What is the name of this control mechanism? (1mark)

Section B: Answer any THREE questions. (30 marks)

15. The figure below shows the structure of the glomerulus and the Bowman's Capsule in the kidney.



- a) What is ultrafiltration? (2marks)
- b) What is the significance of the differences in diameter between the afferent and efferent arterioles? (2marks)
- c) What material passes into the Bowman's Capsule? (2marks)
- d) The loop of Henle and the Surrounding capillary network form a counter-current mechanism. Describe how this mechanism works. (4marks)

16. Homozygous tall, white flowered plants were crossed with homozygous short-red flowered plants. Tall and white are dominant to short and red alleles.

a) What are the genotypes of the parent plants? (2marks)

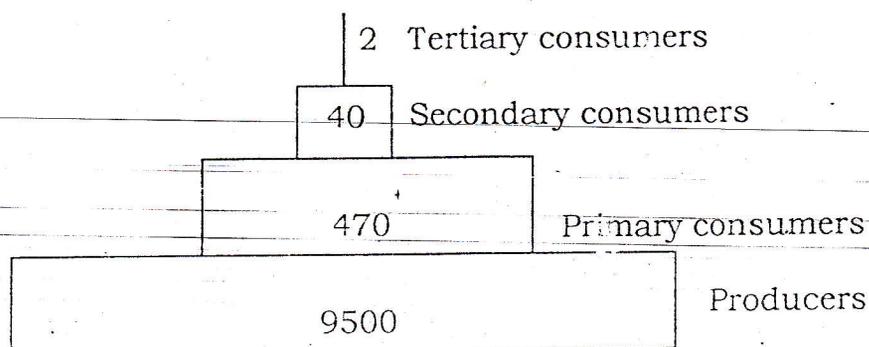
b) What are genotype and phenotype of F_2 ? (2marks)

c) By means of a genetic diagram, show what happens when the F_1 plants are back crossed to a recessive plant. Give the genotype and ratios of the phenotypes of F_2 . (2marks)

17. a) Describe how bile is considered an excretory product as well as a digestive secretion. (4marks)

b) Name two principal hormones controlling the production and release of bile and state the effect of each. (6marks)

18. The figure below shows pyramid of energy for a pond.



a) There are no UNITS given on this pyramid of energy. Suggest suitable UNITS which could have been used to record energy. (2marks)

b) Calculate the percentage energy transfer between primary and secondary consumers. (2marks)

c) Give two reasons why the percentage transfer of energy between trophic levels is low. (2marks)

d) Why are pyramids of energy more informative than pyramids of biomass? (2marks)

e) There are only FOUR trophic levels in this pyramid. Explain why we can not have FIVE. (2marks)

19. Briefly explain the role of each of the following in mammalian locomotion.

- a) Ligament
- b) Tendon
- c) Antagonistic muscles
- d) Bones
- e) Joints

(2marks)

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

20. a) Write an account of the flow of energy through an ecosystem.

(10marks)

b) Explain why the number of trophic levels in an ecosystem is limited to five and rarely six.

(5marks)

21. The table below shows quantities of substances which are filtered, reabsorbed or excreted in the Kidney.

Substance	Quantity filtered into nephron/day	Quantity reabsorbed per day	Quantity excreted per day	% of filtered quantity which is reabsorbed
Water	180 liters	178.5	1.5	
Glucose	800mEq	799.5	0.5	
Urea	56g	28	28	
Sodium ions	25200Eq	25050	150	
Chloride ions	18000mEq	17850	150	
Potassium ions	720m Eq	620	100	

a) Complete the last column by calculating the percentage of the filtered quantity which is reabsorbed.

(6marks)

b) Explain why nearly all of the glucose is reabsorbed.

(4marks)

c) What would be your conclusion if large quantities of glucose were detected in urine?

(2marks)

d) Urea is a nitrogenous waste product. Why is a half of it reabsorbed?

(3marks)