

2404/304
BIOCHEMISTRY, ANATOMY AND
PHYSIOLOGY
Oct./ Nov. 2016
Time: 3 Hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL

DIPLOMA IN APPLIED BIOLOGY

BIOCHEMISTRY, ANATOMY AND PHYSIOLOGY

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

answer booklet;

scientific calculator.

This paper consists of TWO sections; A and B.

Answer ALL the questions in section A and any THREE questions from section B.

Each question in section A carries 4 marks while each question in section B carries 20 marks.

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

This paper consists of 4 printed pages.

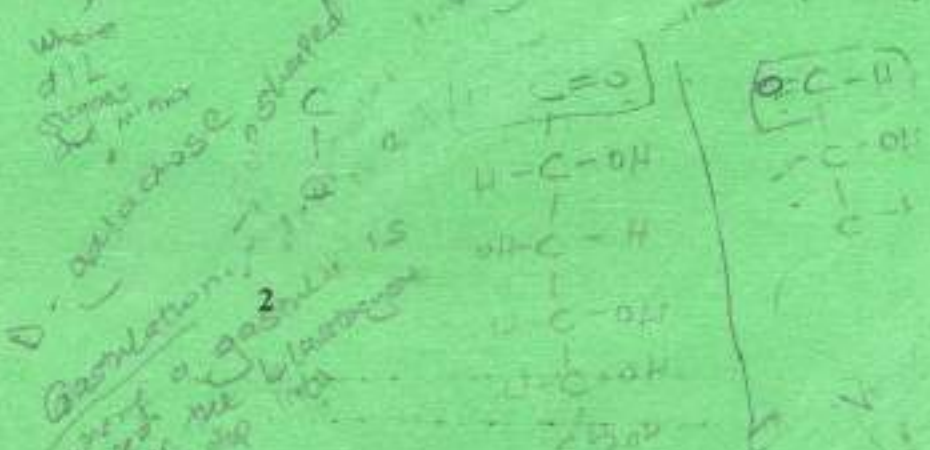
Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

SECTION A (40 marks)

Answer ALL the questions in this section.

1. State any four characteristics of arteries in relation to the transport system. (4 marks)
2. (a) Distinguish between photoautotrophism and chemoheterotrophism. (2 marks)
(b) Explain any two sites of transpiration. (2 marks)
3. Draw a labelled diagram of a single flame cell. (4 marks)
4. (a) Define the term parthenogenesis. (1 mark)
(b) State three disadvantages of plant reproduction by seed. (3 marks)
5. Relate the structure of sertoli cells to their functions. (4 marks)
6. (a) State two advantages of using electrophoresis in the separation and characterization of proteins. (2 marks)
(b) Draw the molecular structures of the epimers of D-Glucose molecule. (2 marks)
7. (a) A common procedure for cleaning the grease trap in a sink is to add a product that contains sodium hydroxide. Explain why this works. (2 marks)
(b) Explain why Fat - soluble vitamins can be stored in the body in amounts sufficient for many months as opposed to water - soluble vitamins. (2 marks)
8. Define the following terms:
 - (a) activation energy; (2 marks)
 - (b) allosteric enzyme. (2 marks)
9. (a) Write the Michaelis-Menten equation. (2 marks)
(b) Define the Michaelis-Menten kinetics. (2 marks)
10. (a) Define the term X-ray crystallography. (2 marks)
(b) Distinguish between Enantiomers and Diastereomers. (2 marks)

Allosteric

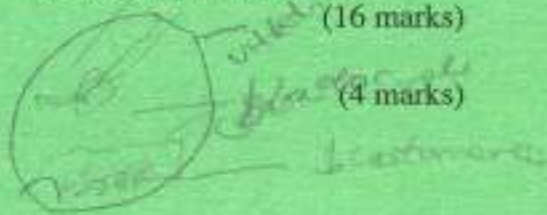


SECTION B (60 marks)

Answer any **THREE** questions from this section.

11. (a) Explain the changes undergone by the zygote immediately after fertilization to its implantation before development of the placenta. (16 marks)

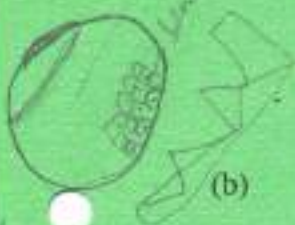
(b) Draw a labelled diagram of the human blastocyst. (4 marks)



12. (a) Explain the following statements:

(i) synaptic convergence should increase visual sensitivity. (4 marks)

(ii) objects are seen more clearly at night by not looking directly at them. (8 marks)



(b) Explain the role of oxyntic/ parietal cells in the human alimentary canal. (8 marks)

13. (a) Discuss the control of ventilation in mammals. (17 marks)

(b) State the roles of the different classes of Ribonucleic acid (RNA) molecules. (3 marks)

14. (a) (i) Describe the structural features that give cellulose and glycogen different physical properties. (7 marks)

(ii) Explain the biological advantages of the respective properties of cellulose and glycogen. (4 marks)

Handwritten notes:
 - Cellulose: linear chains, hydrogen bonds, insoluble, fibrous.
 - Glycogen: branched chains, soluble, osmotic pressure.
 - Advantage of cellulose: structural support, energy storage.
 - Advantage of glycogen: energy storage, osmotic pressure.
 - $K_m = \frac{V_{max}}{2}$
 - Increase in cell mass → increase in number of monomers.
 - Increase in size of the cell → increase in surface area.

Handwritten notes:
 - Microscopic division
 - Increase in size of the cell → increase in surface area
 - They form a mass of cells called the monolayer.
 - $K_m = \frac{V_{max}}{2}$
 - Increase in cell mass → increase in number of monomers.
 - Increase in size of the cell → increase in surface area.



(b) Figure 1 below shows the effect of ATP on the allosteric enzyme PFK - 1.

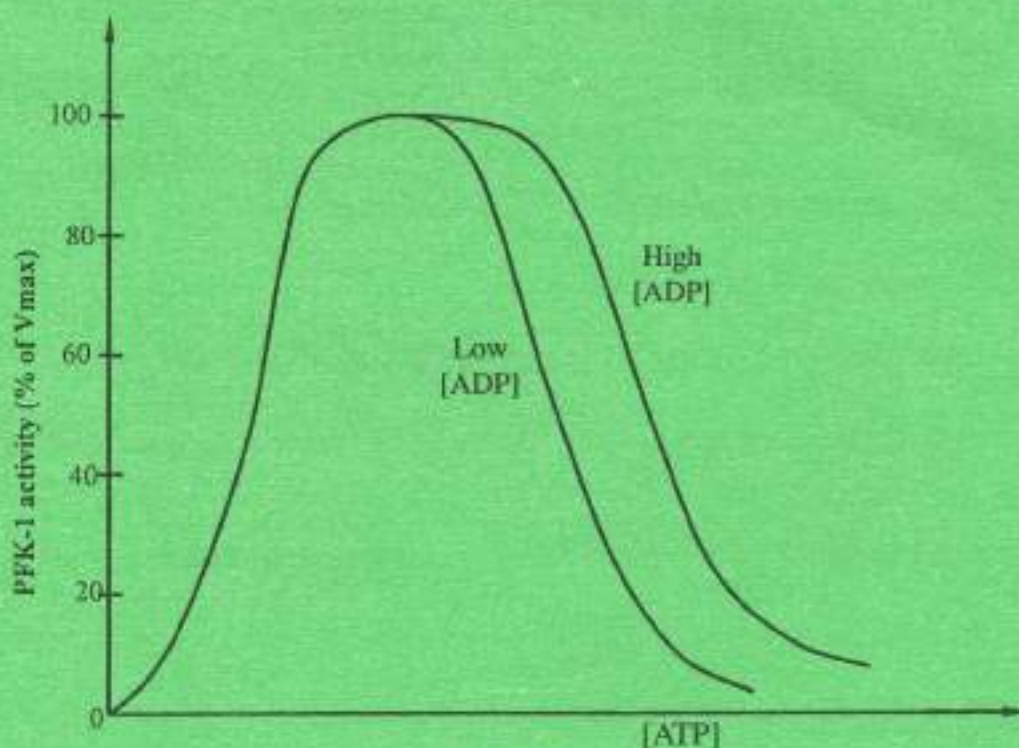


Fig. 1

- (i) Explain how ATP can be both a substrate and an inhibitor of PFK - 1. (2 marks)
- (ii) How is the enzyme regulated by ATP? (3 marks)
- (iii) In what ways is glycolysis regulated by ATP levels? (1 mark)
- (iv) The inhibition of PFK - 1 by ATP is diminished when the ADP concentration is high. Explain this observation. (3 marks)
15. (a) Describe the principles of the following chromatographic methods used in protein purification.
- (i) ion-exchange chromatography; (10 marks)
- (ii) size-exclusion chromatography. (6 marks)
- (b) Although oxygen does not participate directly in the citric acid cycle, the cycle operates only in the presence of oxygen. Explain. (4 marks)

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