2404/304
BIOCHEMISTRY, ANATOMY AND PHYSIOLOGY
Oct./Nov. 2009
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** 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.

This paper consists of 7 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. Describe the entry of fructose into the glycolytic pathway. (4 marks)

2. Describe the fate of pyruvate under anaerobic conditions in the presence of yeast. (4 marks)

3. (a) Define ketogenesis. (1 mark)

   (b) Draw the chemical structures of any **three** ketone bodies. (3 marks)

4. A 1400 ml urine sample obtained from a normal healthy man over a 24 hour period was found to contain the organic constituents urea, creatinine, amino acids and uric acid:

Organic constituent	**Concentration (in grams)**
W	0.7 g
X	1.5 g
Y	0.8 g
Z	25.0 g

   Suggest the identity of the organic constituents W,X,Y and Z. (4 marks)

5. Explain the effect of a malfunctioning pituitary gland on urine output. (4 marks)

6. The figures 1 and 2 show two types of primarose flower which occur naturally in roughly equal numbers and differ in the length of their style and position of anthers.

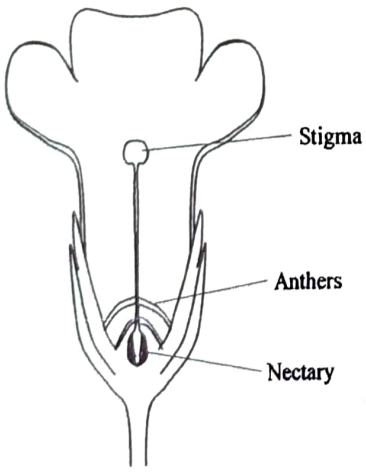

Fig 1 Pin-eyed

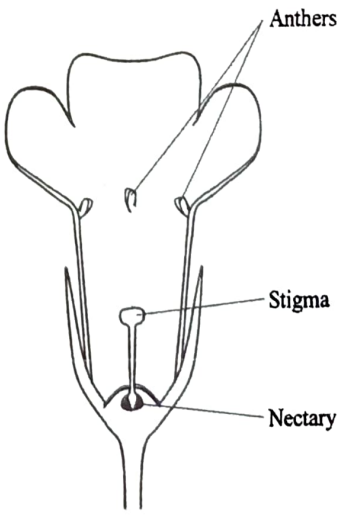

Fig 2 Thrum-eyed

   (a) Given that bees collect nectar from the base of the corolla tube, explain how cross-pollination between pin-eyed and thrum-eyed, rather than between flowers of the same type, is favoured. (3 marks)

   (b) State the advantage of the above system of pollination. (1 mark)

7. Sertoli cells contain abundant smooth endoplasmic reticulum, Golgi apparatus, many Mitochondria and Lysosomes. Suggest the function of these cells in view of their structure. (4 marks)

8. The figure 3 represents the structure of a typical woody dicotyledon stem in the early stages in secondary thickening. Label the parts **a** to **d**. (4 marks)

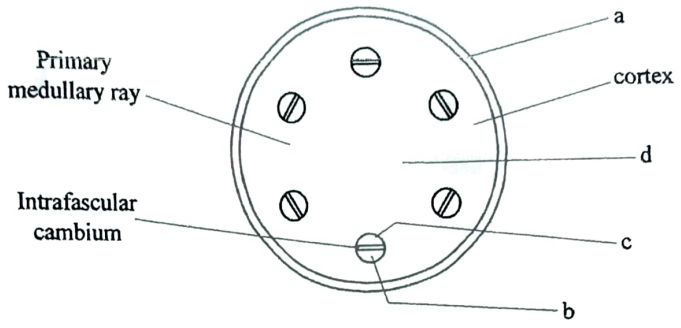

Figure 3

9. List the main steps involved in the translation of mRNA. (4 marks)

10. Match each of the following substances in group **A** with their effects in group **B**.

Group A	**Group B**
Substance	Effects
- Follicle stimulating hormone (FsH)	- milk ejection
- Oxytocin	- stimulation of spermatogenesis
- progesterone	- maintenance of corpus luteum
- human Chorionic Gonadotroplu (hCG)	- inhibition of ovulation.

(4 marks)

SECTION B (60 marks)

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

11. (a) Consider the following curves representing the effect of pH on the activity of enzymes A, B and C.

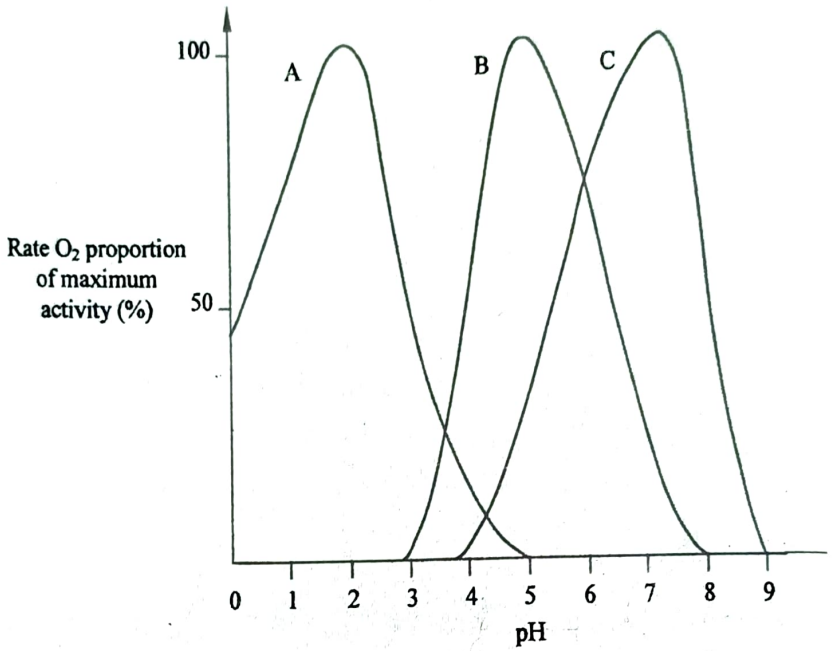

Figure 4; Effect of pH on enzyme activity

(i) Determine the optimum pH for the activity of enzyme B. (1 mark)

(ii) Suggest an enzyme of the alimentary canal that could be represented by:

I activity curve A (1 mark)

II activity curve B. (1 mark)

(iii) Explain why the enzyme activity of curve C decreases at pH value between 8 and 9. (4 marks)

(iv) Explain why pH control is important in cells. (5 marks)

(b) 1 cm^3 of a catalase solution was added to Hydrogen Peroxide solution at different pH values and the time taken to collect 10 cm^3 of Oxygen was measured. The results were:

pH of solution	Time to collect gas (min)
4.00	20.00
5.00	12.50
6.00	10.00
7.00	13.60
8.00	17.40

(i) Sketch a curve showing the activity of the catalase on Hydrogen Peroxide at the varying pH (x-axis). (4 marks)

(ii) Explain the curve in b (i) above. (4 marks)

12. (a) You are provided with three sugar solutions: **A**, **B** and **C**. Solution **A** contains glucose, solution **B** contains a mixture of glucose and sucrose and solution **C** contains sucrose only.

(i) Suggest any preliminary tests that could be used to identify the solutions **A**, **B** and **C**. (8 marks)

(ii) Explain any further experiments that may be performed to confirm the results in a (i). (8 marks)

(b) (i) Describe how to make 100 cm^3 of a 10% glucose solution. (2 marks)

(ii) Starting with a stock solution of 10% glucose and 2% sucrose, show how 100 cm^3 of a mixture whose final concentration is 1% sucrose and 1% glucose, can be made. (2 marks)

13. (a) Explain why plants suffer permanent physiological damage if exposed to temperatures in excess of 30° when the humidity is high. (3 marks)

(b) The latent heat of evaporation of sweat is 2.45 Kj cm^{-3}. Calculate the percentage of energy lost by sweating from a heavy manual worker who loses 4 dm^3 per day of sweat and has a daily energy intake of 50 000 KJ. (4 marks)

(c) Draw a labelled diagram of a human sperm cell. (6 marks)

(d) Consider the following group of lipid substances;

Cholesterol
Prostanglandins
Palmitodistearin
Lecithin
Diterpene
Phosphatidyl ethanolamine
Phosphatidal serine

Assign each of the above substances to any of the following categories of lipids:

- Phosphogylceride
- Derived lipids
- Fats. (7 marks)

14. Figure 5 represents the relationship between light intensity, air temperature and transpiration rate from lucerne leaves.

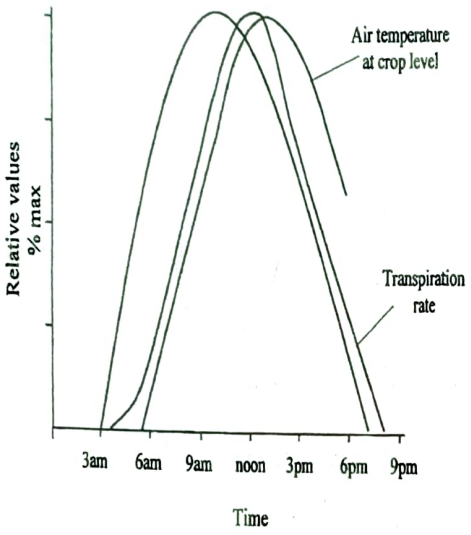

Figure 5

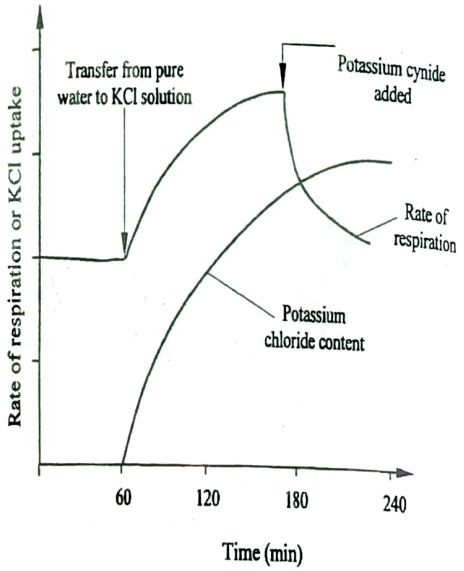

Figure 6

(a) Explain the relationships between the three variable shown. (10 marks)

(b) Figure 6 represents the rate of respiration and uptake of Potassium Chloride by carrot discs.

(i) From the figure, the rate of respiration of the carrot discs increases when they are transferred from pure water to KCl solution. Account for this increase. (3 marks)

(ii) Explain why the rise in KCl content stops when Potassium Cynanide is added. (2 marks)

(c) (i) When an animal is wounded, its overall blood pressure rises but the area in the vicinity of the wound swells as a result local vasodilation. State the advantages of these changes. (2 marks)

(ii) Outline the main adjustments that occur to the heart rate and circulatory system just before a 100 m race. (3 marks)

15. (a) (i) Figure 7 below represents the structure of the human eye. Label parts **A** to **J**. (10 marks)

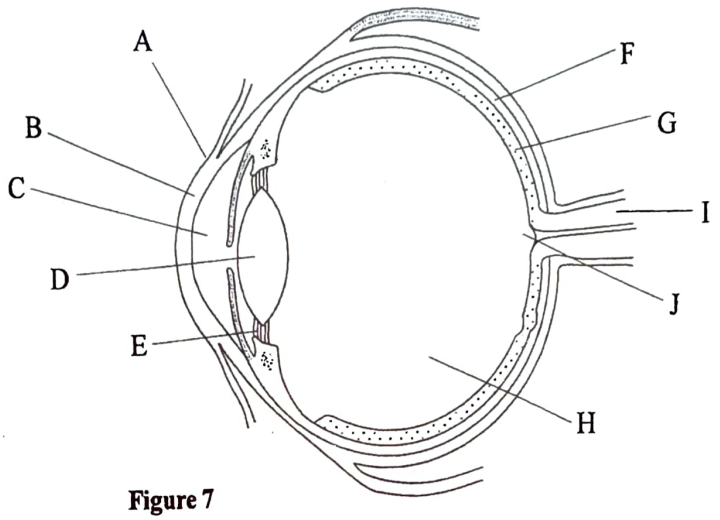

Figure 7

(ii) Arrange the following structures of the eye in the order in which light passes before striking the retina: vitreous humour, aqueous humour, lens, conjuctiva, cornea, retina. (2 marks)

(b) Figure 8 below represents the structure of a mamalian synovial joint.

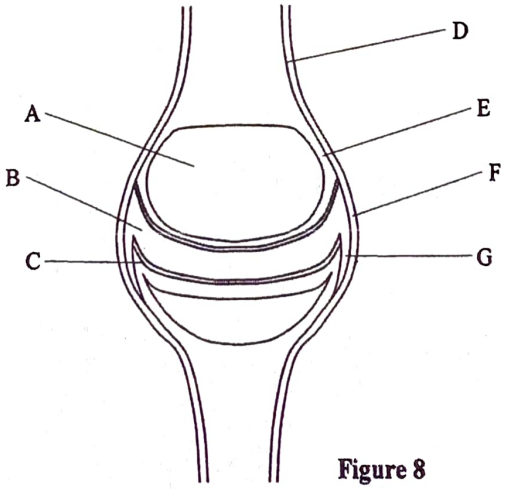

Figure 8

(i) Identify the parts labelled **A** to **G**. (7 marks)

(ii) Name the body fluid contained in structure **B**. (1 marks)