

MENGO SS S.5 BIOLOGY HOLIDAY PACKAGE

Below is a list of terms that are used in examination questions. It is important that you familiarize yourself with these terms and what is expected in your answers when such terms are encountered.

1. Analyse:	Interpret data to reach conclusions.
2. Annotate:	Add brief notes to a diagram, drawing or graph.
3. Apply:	Use an idea, equation, principle, theory or law in a new situation.
4. Calculate:	<ul style="list-style-type: none">Find an answer using mathematical methods.Show all the working unless instructed not to.
5. Compare:	State the similarities and differences between the two or more topics given in the questions.
6. Construct:	Represent or develop information in a graphical form.
7. Contrast:	Show differences. Set in opposition.
8. Deduce:	Reach a conclusion from the information given.
9. Define:	Give the precise meaning of a word or phrase as concisely as possible.
10. Design:	Produce a plan, model or simulation
11. Describe:	State in words (using diagrams when appropriate) the main points the topics you are asked to describe.
12. Determine:	Find the only possible answer.
13. Discuss:	Give a critical account of all the points involved in the topic being written about and their relative importance. Present them in an orderly way in your answer.

14. Distinguish	Give the differences between two or more different items or concepts.
15. Draw:	<ul style="list-style-type: none"> • Represent by means of pencil lines. • Add labels unless told not to do so. • Diagrams may form the basis of a question or be used to illustrate a point in another type of question. • Diagrams represent a simplified or idealized representation while drawings are usually made directly from the object and occur in practical examinations.
16. Estimate:	Find an approximate value for an unknown quantity, based on the information provided and prior scientific knowledge.
17. Evaluate:	Assess the consequences and limitations.
18. Explain:	State all the details which affect the subject and enable it to be clearly understood.
19. Identify:	Find an answer from a number of possibilities.
20. Illustrate:	<ul style="list-style-type: none"> • Give concrete examples. • Explain clearly by using comparisons or examples.
21. List:	Write down the facts as briefly as possible each fact should be numbered.
22. Name:	Write down the names of structures, process or organisms required by question.
23. Predict	Give an expected result.
24. Solve	Obtain an answer using algebraic and/or other numerical methods.
25. State:	Give a brief account or summary. Include essential information only.
26. Outline:	<ul style="list-style-type: none"> • Give a specific name, value, or other answer. • No supporting argument or calculation is necessary.

27. Suggest:

State your answer on the basis of theoretical knowledge.
Propose a hypothesis or other possible explanation

TOPIC 1: CELL BIOLOGY

1. Explain the various ways in which a typical eukaryotic cell is adapted to its functions. (20 marks)

2. **Figure 1** shows changes in the quantities of nuclear DNA and cell mass during one and half cell cycle. **Figure 2** represents changes during metaphase of mitosis in the distance between:

- (i) Centromeres of chromatids and pole of the cell.
- (ii) Centromeres of sister chromatids.

Fig. 1: changes during cell cycle

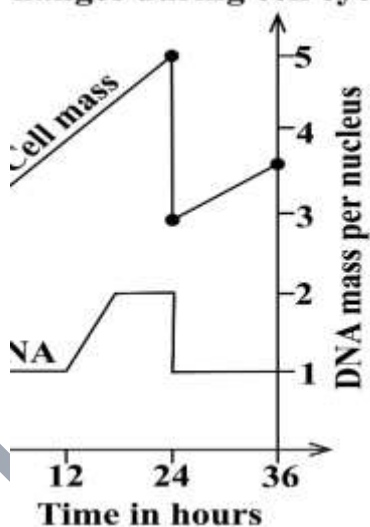
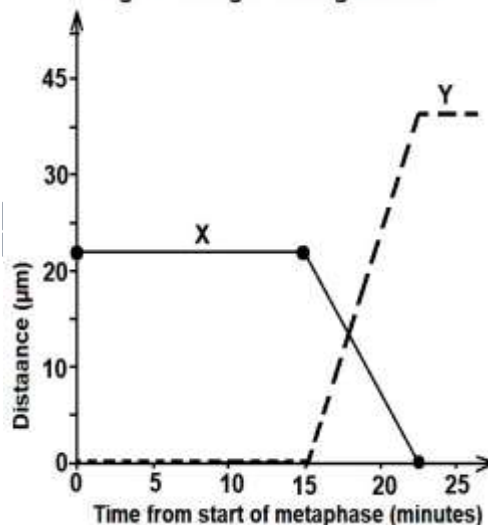


Fig. 2: changes during mitosis



State the stage(s) of cell cycle in figure 1:

- (a) (i) Between 0 to 12 hours. (01 mark)

- (ii) Between 12 to 18 hours. (01 mark)
- (iii) Between 18 to 24 hours. (01 mark)
- (iv) At 24 hours. (02 mark)
- (b) For one complete cell cycle, describe the changes in:
 - (i) Mass of DNA (04 marks)
 - (ii) Cell mass (03 marks)
- (c) For one cell cycle only, explain the trend in:
 - (i) Mass of DNA (08 marks)
 - (ii) Cell mass (08 marks)

- (d) Explain the significance of the observed changes in mass of DNA from 12 hours to about 23 hours. (02 marks)
- (e) Identify what curves X and Y represent in figure 2. (01 mark) (f) Explain the trend in distance represented by:
 - (i) Curve X (08 marks)
 - (ii) Curve Y (08 marks)
- (g) Explain the variation in the maximum distance achieved in X and Y (03 marks)

- 3.**
- (a) Describe the structure of the plasma membrane according to:
 - (i) Singer and Nicolson model (10 marks)
 - (ii) Danielli and Davson model (05 marks)
 - (b) Explain the role of proteins within plasma membranes. (05 marks)

- 4.**
- (a) Describe how the DNA replicates according to semi-conservative theory. (10 marks)
 - (b) State the differences between:
 - (i). DNA transcription and translation. (03 marks)
 - (ii). DNA and RNA (07 marks)

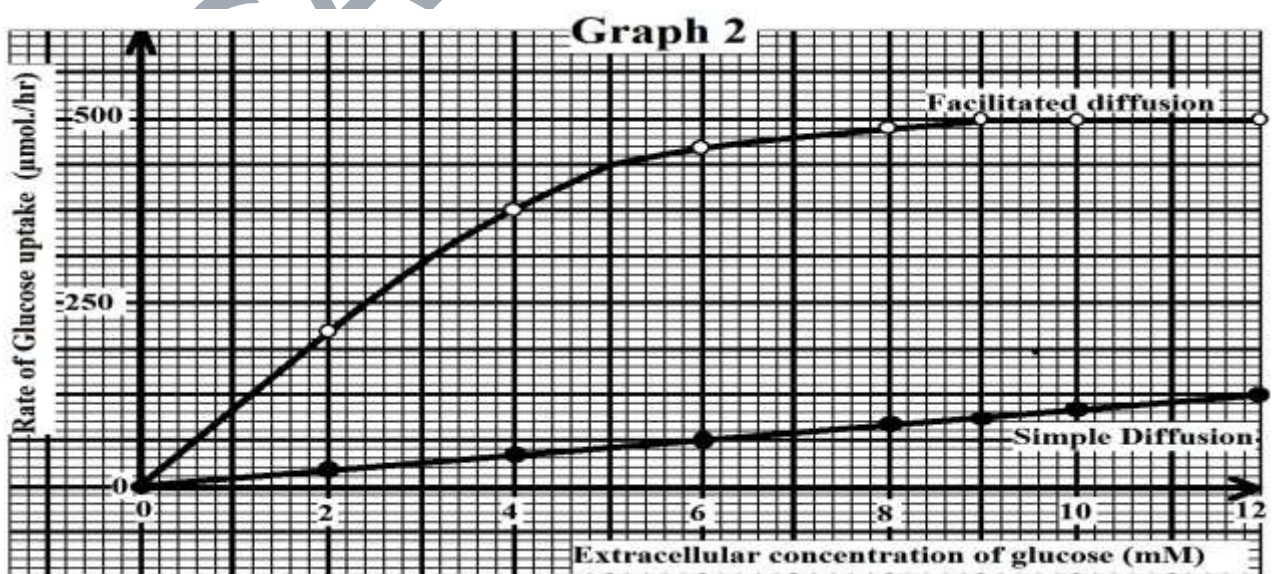
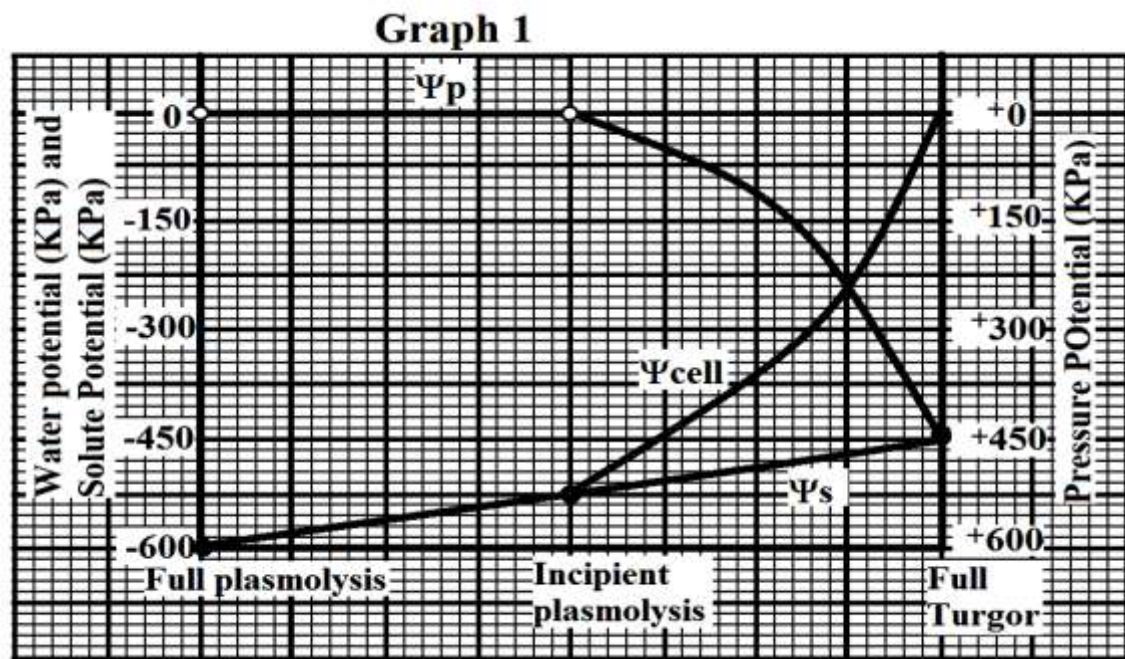
5. (a) Describe the role of the following during protein synthesis:
- (i) tRNA (03 marks)
 - (ii) mRNA (03 marks)
- (b) Compare the processes of DNA replication and transcription. (06 marks)
- (c) Describe the characteristics of a genetic code. (05 marks)
- (d) Suggest evidence that DNA is a hereditary material. (03 marks)
6. (a) Describe distribution and function of epithelia in mammals. (10 marks)
- (b) Explain how the epithelial tissue is adapted for its functions. (10 mark)
7. (a) Describe the changes that occur in a nucleus of an animal cell during prophase I of meiosis I. (09 marks)
- (b) State the significance of mitosis and meiosis to living organisms. (07 marks)
- (c) State the differences between prophase of mitosis and prophase I of meiosis. (04 marks)
8. Describe how the various supportive tissues in plants adapt them to their habitats. (20 marks)
13. (a) Distinguish between passive transport and active transport. (02 marks)
- (b) (i) What is meant by **Sodium-Potassium Pump**? (02 marks)
- (ii) Describe how the Sodium-Potassium Pump works. (05 marks)
- (c) Compare simple diffusion with facilitated diffusion. (11 marks)

TOPIC 2: CHEMICALS OF LIFE

- 9.** (a) Outline the role of minerals and ions in biological systems. (07 marks)
- (b) Describe how the properties of water are relate to its biological role. (13 marks)
- 10.** (a) Describe how the following structures are relate to their functions:
- (i). Starch (05 marks)
 - (ii). Amino acids (05 marks)
 - (iii). Cellulose (05 marks)
- (b) State the differences between cellulose and starch. (05 marks)
- 11.** (a) Give an account of the chemical nature and variety of carbohydrates. (16 marks)
- (b) Outline the role of carbohydrates in the life of a plant. (04 marks)
- 12.** (a) Describe the induced fit hypothesis of enzyme action. (07 marks)
- (b) Explain how:
- (i) Temperature affects enzyme activity. (05 marks)
 - (ii) Enzyme's activities are regulated. (08 marks)

TOPIC 3: CELL PHYSIOLOGY

- 14.** (a) Distinguish between passive transport and active transport. (02 marks)
- (b) (i) What is meant by **Sodium-Potassium Pump**? (02 marks)
- (ii) Describe how the Sodium-Potassium Pump works. (05 marks)
- (c) Compare simple diffusion with facilitated diffusion. (11 marks)
- 15.** Graph **1** shows changes in the different potentials of a fully plasmolysed plant cell placed in hypotonic solution, and graph **2** shows the rate of uptake of glucose by blood using simple and facilitated diffusion at varying extracellular concentration of glucose.



(a) Define the following terms:

- (i) Water potential (01 marks)
- (ii) Pressure potential solute (01 marks)
- (iii) Solute potential (01 marks)

(b) Describe the changes in:

- i) Pressure potential from full plasmolysis to full turgor. (03 marks)
- ii) Water potential from full plasmolysis to full turgor. (03 marks)

(c) Explain the changes in water potential from full plasmolysis to full turgor. (12 marks)

(d) Compare the effect of increasing extracellular concentration of glucose on the rates of up take of glucose by simple and facilitated diffusion. (03 marks)

(e) Explain the effect of increasing extracellular concentration of glucose on the rates of up take of glucose when the diffusion is facilitated. (11

marks) (f) Outline the differences between the functioning of carrier proteins in facilitated diffusion and those in active transport. (05 marks)

TOPIC 4: LEVELS OF ORGANISATION AND DIVERSITY OF LIFE

15. (a) State **four** features that distinguish viruses from bacteria. (04 marks)

(b) State the roles of the following organisms in the environment:

- (i) Viruses (03 marks)
- (ii) Protoctists. (03 marks)
- (iii) Bacteria. (05 marks)
- (iv) Fungi. (05 marks)

State the differences between the following organisms:

- 16.** (a)
- (i) Bryophytes and pteridophytes (05 marks)
 - (ii) Centipedes and millipedes (04 marks)

(b) State the roles of the following organisms in the environment:

(i) Plants

(06 marks)

ii) Animals

(05 marks)

TOPIC 5: ECOLOGY

17. A factory emitting smoke containing Sulphur dioxide was sited in a rural district. The tables below give distances and directions of:

(i) Number of lichen species and

(ii) Sulphur dioxide concentration in the atmosphere at different directions from the factory chimney.

Table 1

Distance in miles from the factory in South, South-West direction	1	2	4	8	12	16	28	40
Number of lichen species	0	1	2	3	7	9	14	21
Sulphur dioxide concentration in parts per million (pmm)	28	27	26	23	19.5	16	2	0

Table 2

Distance in miles from the factory in North, North-East direction	1	2	4	8	12	16	28	40
Number of lichen species	1	2	3	4	4	5	5	5
Sulphur dioxide concentration in parts per million (pmm)	27	26.5	25	24	23	22	19	17

(a) Plot the information given to show the relationships between the lichen species distribution and the Sulphur dioxide concentration using the same X-axis and two Y-axes, one on the right for Sulphur dioxide concentration and the one on the left for the number of species.

(09 marks)

- (b) Explain the difference in the results between those obtained for the South, South-West direction and those obtained for the north, north-east direction. (08 marks)
- (c) Explain why the number of lichen species changes with changes in the distance from the factory (05 marks)
- (d) What are the environmental effects of Sulphur dioxide pollution? (04 marks)
- (e) Using the information given from the tables above and your graphs, explain how lichens can be used as indicator species to show the extent of pollution in an environment. (04 marks)

(f) The amount of oxygen present in a water body can be used to show the extent of pollution in the water body. This is indicated as the biochemical oxygen demand (BOD) of the water body.

(i) Explain the changes in the BOD of a river when untreated sewage is discharged into such a river. (05 marks)

(ii) Explain the changes in the nitrate concentration of the river in which untreated sewage has been discharged. (05 marks)

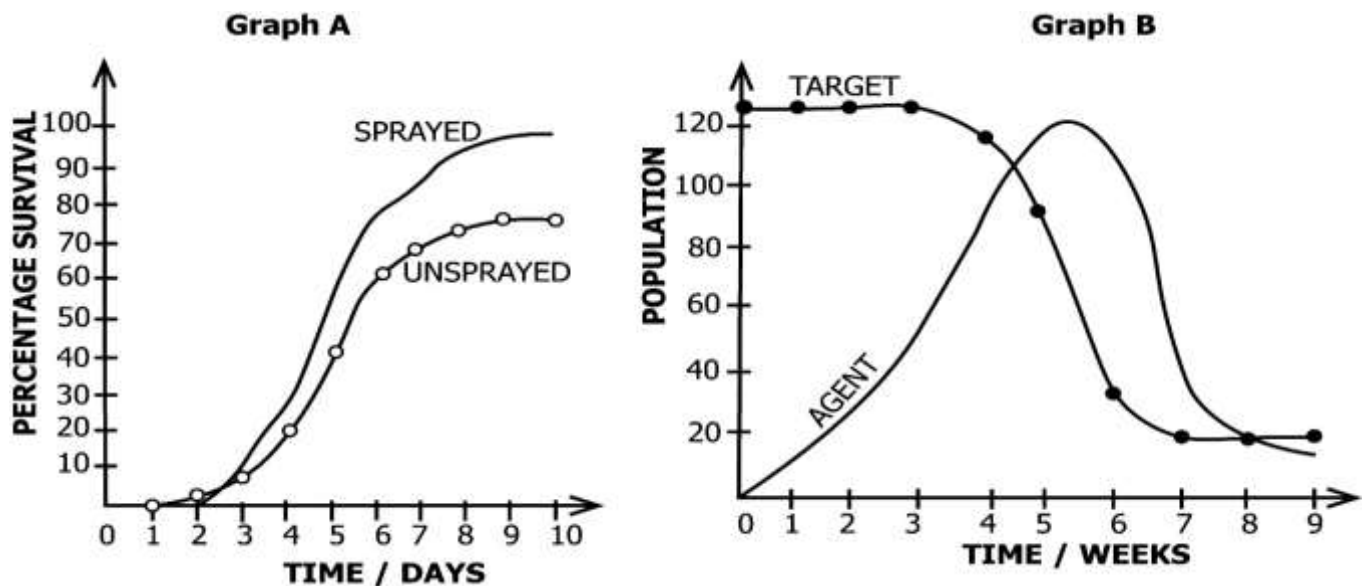
18. (a) What is **pest resurgence**? (02 marks)

(b) suggest reasons why pest resurgence arise when a broad-spectrum pesticide is used in controlling pest population. (06 marks)

(c) Give two other effects of prolonged pesticide application in controlling pest population. (02 marks)

19. In an experiment to study the effectiveness of DDT towards the cabbage pest, **Pieris rapae** which feeds on cabbage leaves, two adjacent farm yards were prepared and **Pieris** was introduced in each farm and left for some time. After spraying one farm yard with DDT for three consecutive times, the number of eggs that survived and hatched into larvae at the sprayed and non-sprayed farm yards was determined as shown by **Graph A**.

In another set of experiment, **Pieris rapae** was exposed to birds as its control agents and the changes in the population of both, with time was determined as indicated by **Graph B**. Study the graphs and answer the questions that follow.



- (a) (i) Account for the increase in the population of the control agent. (05 marks)
- (ii) Explain the decrease in the population of the control agent. (05 marks)
- (b) (i) Account for the decrease in the population of **Pieris rapae**. (05 marks)
- (ii) Account for the population of **Pieris** and that of the control agent from 8½ to the 9th week. (04 marks)
- (c) Compare the number of eggs of **Pieris** between the sprayed and nonsprayed farm yards. (05 marks)
- (d) Account for the differences in the number of eggs of **Pieris** at the sprayed and non-sprayed farm yards. (08 marks)
- (e) Explain any one property of DDT other than the one shown above, which render it unsuitable for environmental use. (05 marks)
- (f) Outline any three advantages of the method used in Graph B to that used in Graph A. (03 marks)

TOPIC 6: INHERITANCE AND EVOLUTION

20. (a) What is meant by the following terms:
- (i) **Crossing over?** (02 marks)
- (ii) **Dihybrid inheritance?** (02 marks)
- (b) How does crossing over cause variation in sexually producing organisms? (04 marks)

- (c) In maize some varieties have purple grains due to the presence of a pigment called anthocyanin in their seed coat. In the absence of the pigment, the grains are white. The production of anthocyanin is controlled by two genes **A** and **B**. The dominant alleles of both genes when together, code for the functional enzymes for the production of anthocyanin, while homozygous recessive alleles of both genes code for a non-functional enzyme leading to lack of the colour in the grains.
- (i) Using appropriate crosses, determine the phenotype of the offspring obtained when a pure breeding variety of white-seeded maize with the genotype **Aabb** is crossed with another pure breeding variety of white seeded maize with the genotype **aaBB**. (04 marks)
- (ii) Determine the genotypes, phenotypes and the phenotypic ratio if two of the offspring from the cross in (c) (i) are cross bred. (08 marks)

- 21.** (a) Describe how species arise according to Darwin's theory. (07 marks) (b) Explain how each of the following can affect the gene frequency within a population:
- (i) Biased mating. (03 marks) (ii) Disruptive selection. (05 marks)
- (iii) Mutation. (05 marks)

- 22.** (a) Distinguish between **dominance** and **epistasis** (01 mark)
- (b) In fruit fly, the genes for body colour and wing length are located on the same chromosome. A wild-type fruit fly (heterozygous for grey body color and normal wings) is mated with a black fly with vestigial Wings. The offspring have the following phenotypic distribution: wild type, 778; black-vestigial, 785; black-normal, 158; grey-vestigial, 162.
- (i) Draw a genetic diagram to show genotypes of the offspring of the cross. State the genotypic ratio of the offspring. (06 marks) (ii) Define the term **cross over frequency**. (01 marks)
- (iii) Calculate the cross over frequency between these genes for body color and wing size. (02 marks)

- 23.** (a) Distinguish between mutations, mutants and mutagens. (06 marks)
- (b) Give **two** causes of mutations. (02 marks)

(c) Describe the causes and effects of chromosomal mutations. (12 marks)

24. Discuss the various evidences of organic evolution. (20 marks)

TOPIC 7: TRANSPORT

25. Describe how the mammalian body protects itself against infections. (20 marks)

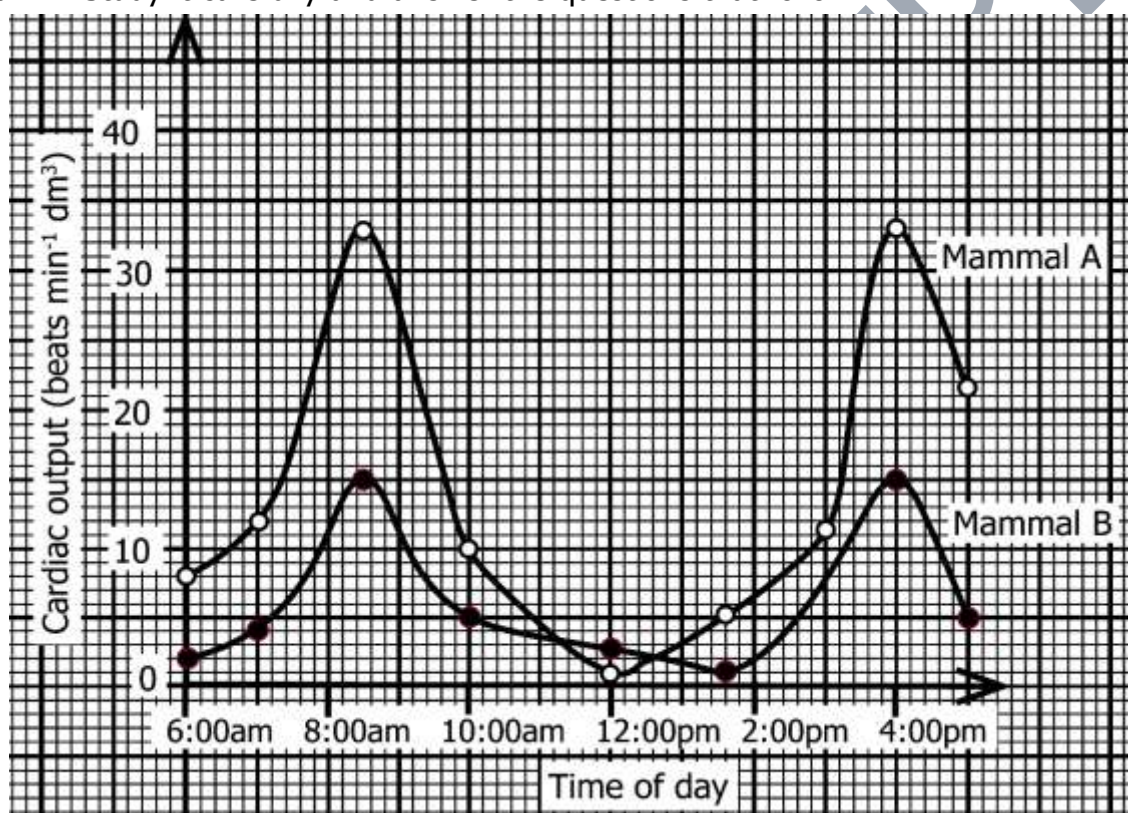
26. Describe how does the:

(a) Cohesion-tension theory explains the ascent of water in the xylem.

(10 marks)

(b) Potassium ion pump mechanisms regulate the opening and closing of stomata.
(10 marks)

27. The graph below shows the change in the cardiac output of two individual mammals A and B of different sizes, over a 10-hour period when the mammals were given a hot drink. Study it carefully and answer the questions that follow.



(a) (i) Describe the changes in the cardiac output of mammal A over the 10-hour period.

(06 marks)

(ii) Explain the changes in the cardiac output of mammal A over the 10-hour period.

(07 marks)

(b) (i) Compare the cardiac output of both mammals over the 10-hour period.

(08 marks)

(ii) Account for the difference in the cardiac output of the two mammals over the 10-hour period.

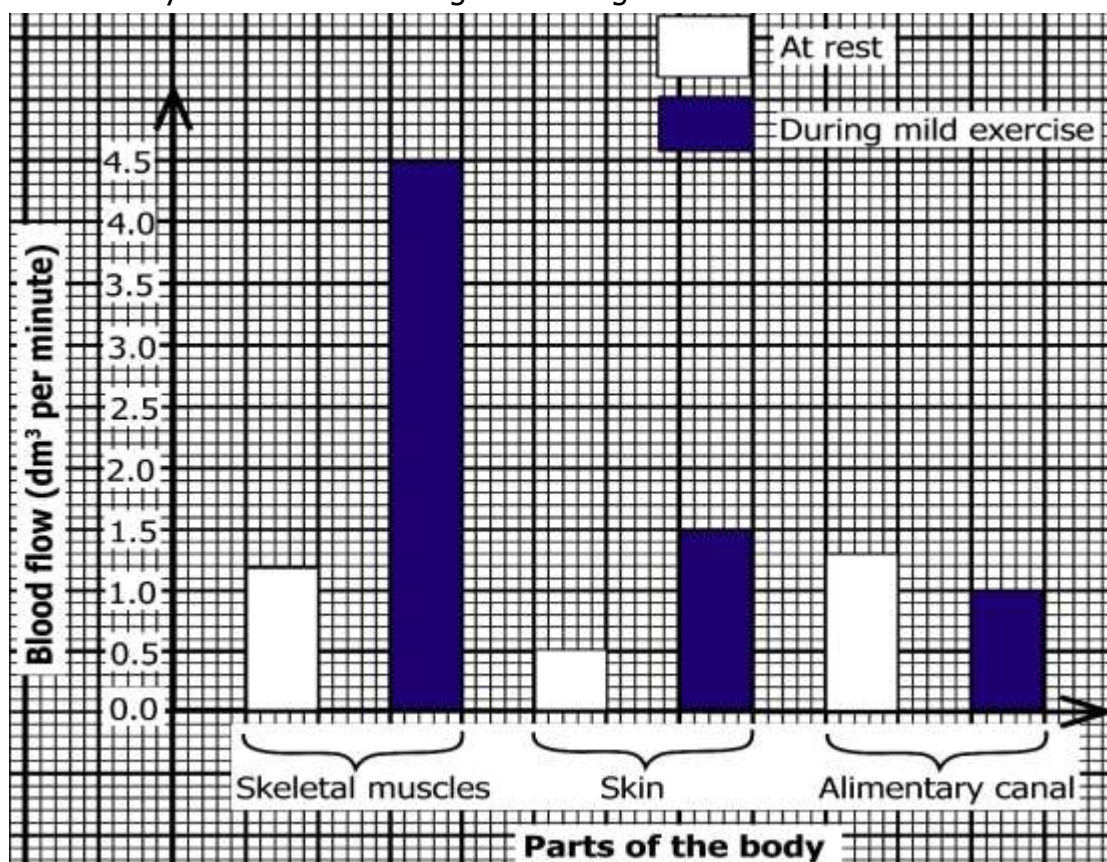
(05½ marks)

(c) Suggest three factors that are likely to affect the cardiac output of a

mammal.

(03 marks)

- (d) The graph in the figure below shows amount of blood flow in skeletal muscles, the skin and alimentary canal where resting and during mild exercise.



- (i) Calculate the percentage change in blood flow to the different parts of the body during exercise. (03 marks)
- (ii) Account for the observed trends in blood flow to the body parts as shown in the figure. (05½ marks)
- (iii) Give two ways by which percentage in blood flow of the skeletal muscles in (d) (ii) above can be achieved. (02 marks)

28. The data below was obtained from experiments using plant materials treated as shown below. **Figure 1** shows the rate of uptake of potassium ions in carrot discs which were transferred from pure water to potassium chloride solution. Potassium cyanide was then added to the solution after 90 minutes' duration of the experiment.

Figure 2 shows the rates of respiration and uptake of potassium ions by young cereal roots. The roots had previously been thoroughly washed in pure water and transferred to potassium chloride solution after 60 minutes. Potassium cyanide was then added to the solution after 180 minutes.

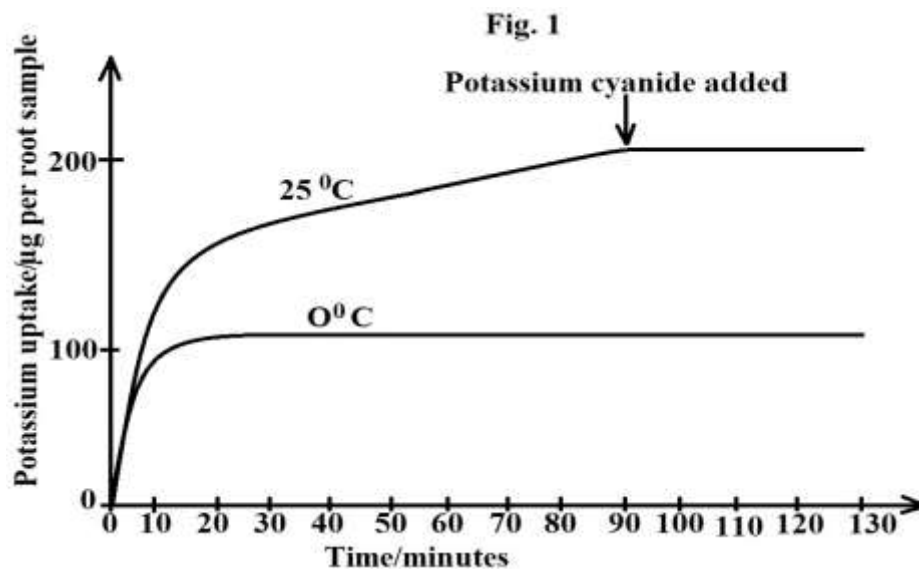
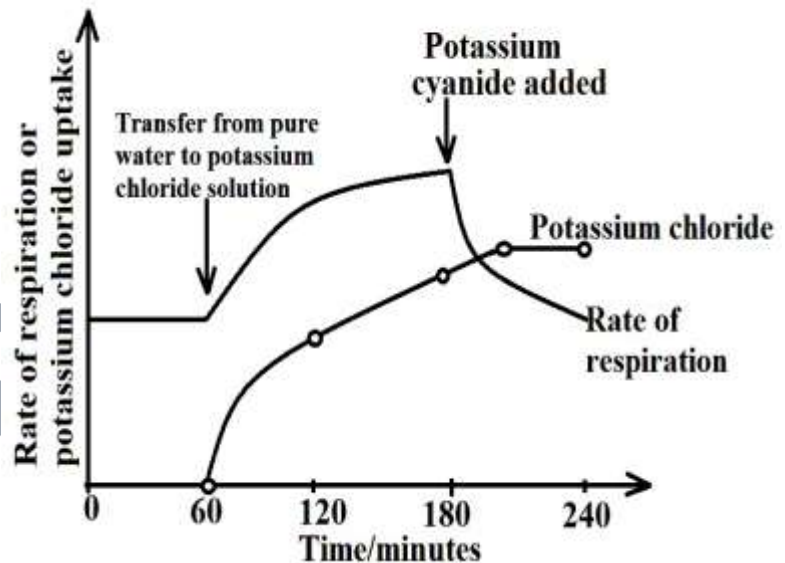


Fig. 2



- (a) (i) Compare the uptake of potassium ions at 0 $^{\circ}\text{C}$ and 25 $^{\circ}\text{C}$ in **Fig. 1**.

1. (06 marks)

- (ii) Account for the observed difference in active uptake of potassium ions at the given temperatures.

(06 marks)

- (iii) Suggest a reason why the cereal roots were washed before placing them in a solution containing potassium ions. (01 mark)

- (b) With reference to **Figure 2** above:

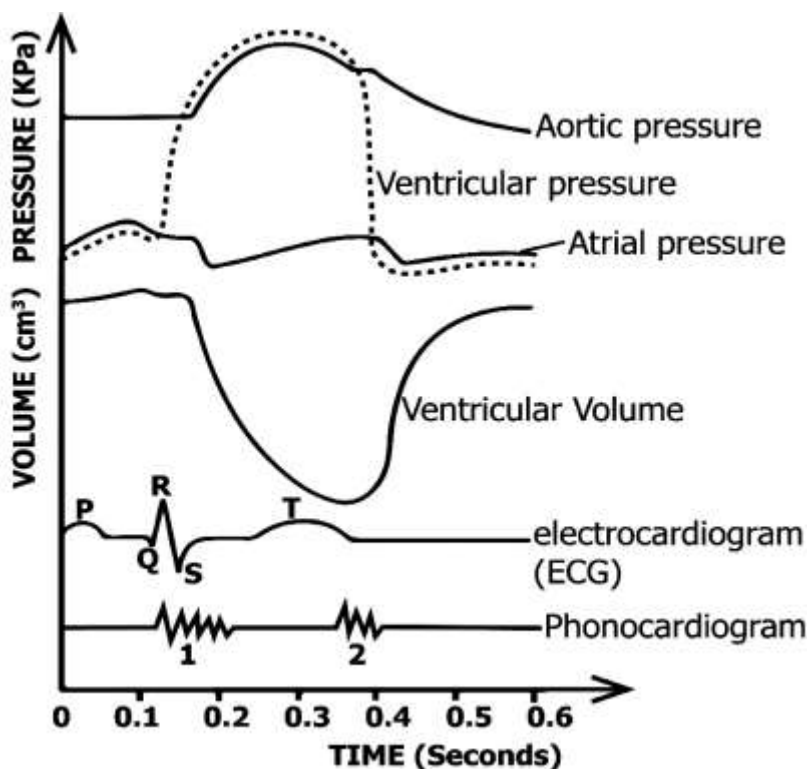
- (i) Describe and explain the observed trend in rate of respiration before addition of potassium cyanide. (10 marks)

- (ii) Account for the rate of respiration after addition of potassium cyanide. (07 marks)

- (c) State the **two** mechanisms of uptake of mineral salt by plants and give **three** differences between them. (04 marks)

- (d) Apart from the factors shown in figures **1** and **2**, state and explain three other factors that affect the rate of mineral uptake by plants. (06 marks)

- 29.** The figure below shows the pressure and volume changes that occur during the mammalian cardiac cycle (of a dog). The pressure changes were measured in the left atrium and ventricle, and the aorta. Volume changes were measured for both ventricles. The electrical activity in the heart wall (electrocardiogram) and heart sounds (phonocardiogram) as recorded in a human subject are also shown.



- (a) Describe the changes in:

(i) Atrial pressure.

(07

marks)

(ii) Ventricular pressure.

(07 marks)

- (b) Compare the changes in ventricular pressure and ventricular volume between 0.1 seconds and 0.5 seconds? (05 marks)
- (c) Explain the effect of the changes in atrial, aortic and ventricular pressures to blood flow during the cardiac cycle. (10 marks)
- (d) State the significance of the relationship between aortic and ventricular pressures. (03 marks)
- (e) What is represented by the:
- (i) Waves on the electrocardiogram? (03 marks)
- (ii) Sounds **1** and **2** on the phonocardiogram? (02 marks)
- (f) Explain **three** factors that ensure efficient flow of blood within the mammalian heart. (03 marks)

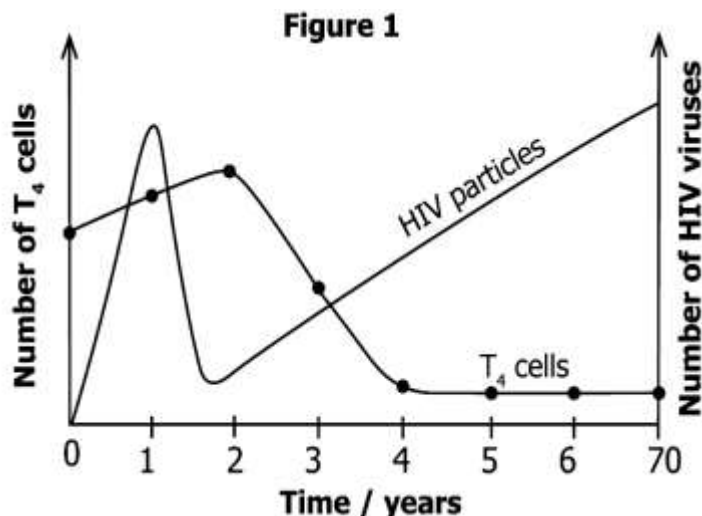
- 30.** A study was conducted on the effect of the development of an infection with Human Immunodeficiency Virus (HIV) over a period 10 years and its effect on the number of T₄ lymphocytes (T-lymphocytes) in the body. The

results are presented in the figure 1 shown below. Study the figure and answer the questions that follow.

- (a) Compare the trends shown by the two curves. (05 marks)

- (b) Explain the differences between the number of T_4 cells and number of HIV particles in blood over the period of the study. (11 marks)

- (c) Using the results in the graph above, explain the occurrence of the opportunistic infections in the later years of the infection. (04 marks)
- (d) Suggest the possible ways of controlling number of HIV particles. (04 marks)



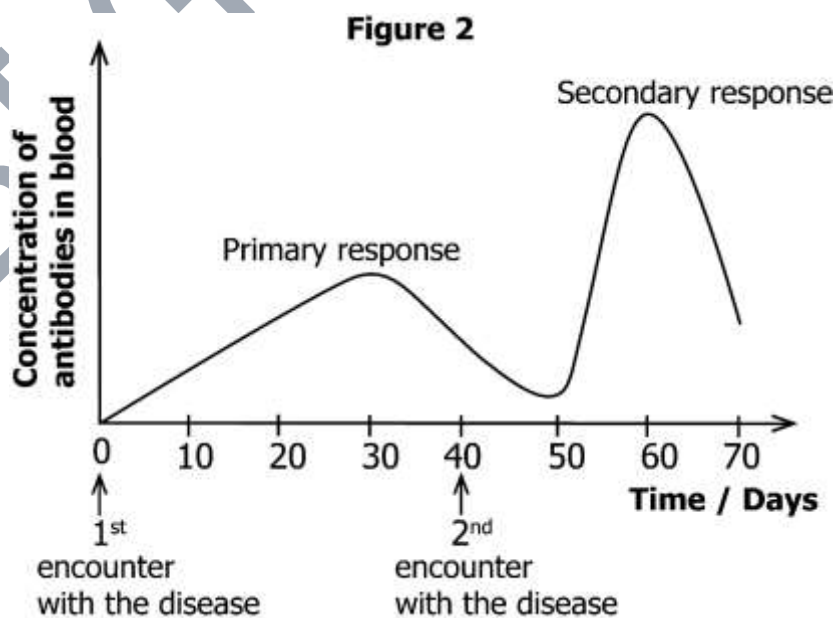
- (e) In another experiment, the quantities of antibodies produced in the first infections and second infections by the same disease was studied and the results are shown in the figure 2 below. Study it and answer the questions that follow.

- (i) Describe the changes in the curve shown above. (02 marks)

- (ii) Explain the differences between primary response and secondary response using the graph above. (06 marks)

- (iii) What is the significance of the above phenomenon to immunity and disease control? (02 marks)

- (f) (i). With the aid of a well-labelled diagram describe the structure of an antibody. (03 marks)

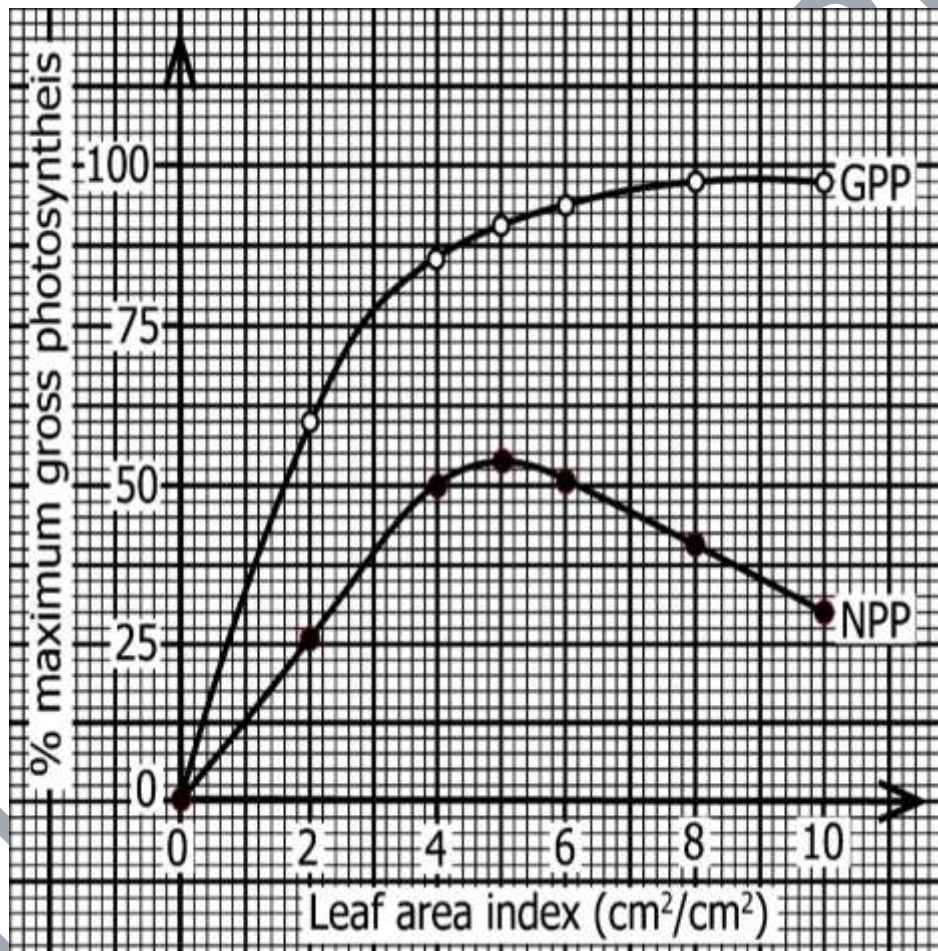


- (ii). Describe the ways how an antibody can combat and destroy the antigen.
(03 marks)

TOPIC 8: NUTRITION

31. The figure below shows the relationship between gross primary productivity primary productivity (NPP) with increasing leaf area index

(surface area of a leaf available for photosynthesis). Study questions that answer the follow.



(a) How does leaf area index affect the changes in GPP and NPP of the

plant?

(06 marks)

(b) Compare the effect of leaf area index on GPP and NPP of the plant.

(06 marks) (c)

Explain the effect of leaf area index on each of the following:

(i) GPP

(08 marks)

(ii) NPP

(13 marks)

(d) Suggest why plants grown in green houses attain higher net primary productivities.
(04 marks)

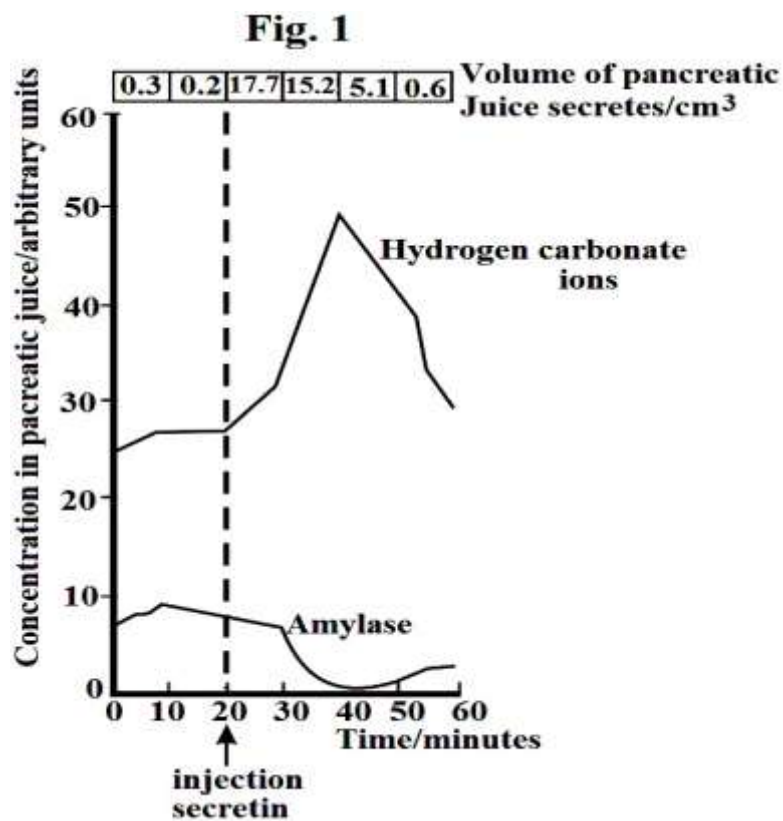
(e) Outline the factors which limit net primary productivity in nature.

(04 marks)

32. The graph on the right shows how an injection of secretin affects the secretion of pancreatic juice by the pancreas.

From **Figure 1** above:

- (a)** (i) Use the graph to describe the effect of secretin on the pancreas. (04 marks)
- (ii) Explain why the concentration of amylase in the pancreatic juice decreased shortly after the injection of secretin. (03 marks)



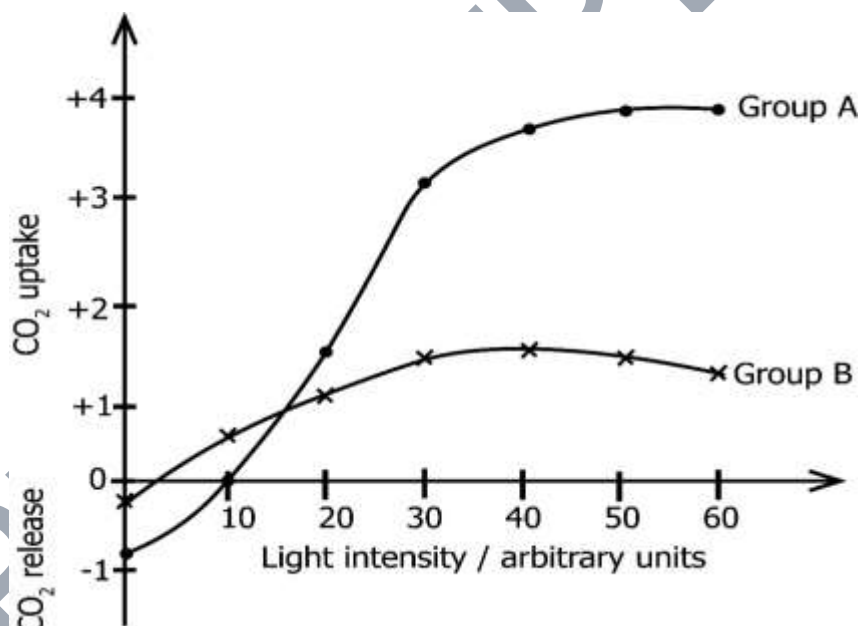
- (b)** What other digestive secretion is stimulated by secretin. (02 marks)
- (c)** Certain types of ulcers are thought of to be made worse by the production of too much acid from the stomach. Doctors have used a number of different methods to treat these ulcers. Suggest how the following treatments might reduce the amount of acid secreted by the stomach:
- (i) Cutting the vagus nerve to the stomach. (06 marks)
- (ii) Giving the patient atropine, a drug which blocks the action of acetylcholine. (06 marks)
- (d)** Giving example explain how organisms are able to utilize cellulose in their diet. (10 marks)
- (e)** In what ways are saprophytes important to man? (09 marks)

33. (a) Distinguish between photosynthesis and chemosynthesis. (02 marks) (b) Explain how:

- (i) Certain bacteria which require light for photosynthesis survive under weeds in the ponds and rocks. (04 marks) (ii) Chemosynthesis occurs in nitrifying bacteria. (06 marks) (c) Explain how the physiology of the leaves of C4 plants is adapted for efficient carbon dioxide fixation at high temperatures. (08 marks)

- 34.** (a) Define the term **absorption spectrum**. (01 mark) (b) State two:
- (i) Evidence that shows that photosynthesis is a two-stage process. (02 marks)
 - (ii) Roles of the light dependent stage during carbon dioxide fixation. (02 marks)
- (c) Describe the **Hatch-Slack** pathways. (05 marks)

35. In an experiment, equal numbers of leaf discs were cut out from leaves of two groups of plants of the same species. Group A was obtained from a habitat that is in open light while Group B was obtained from under the canopy of a forest. The discs were then floated in water containing sodium hydrogen carbonate and the rate of uptake (+) and release (-) of carbon dioxide at varying light intensities was determined. The results are shown in the figure below.

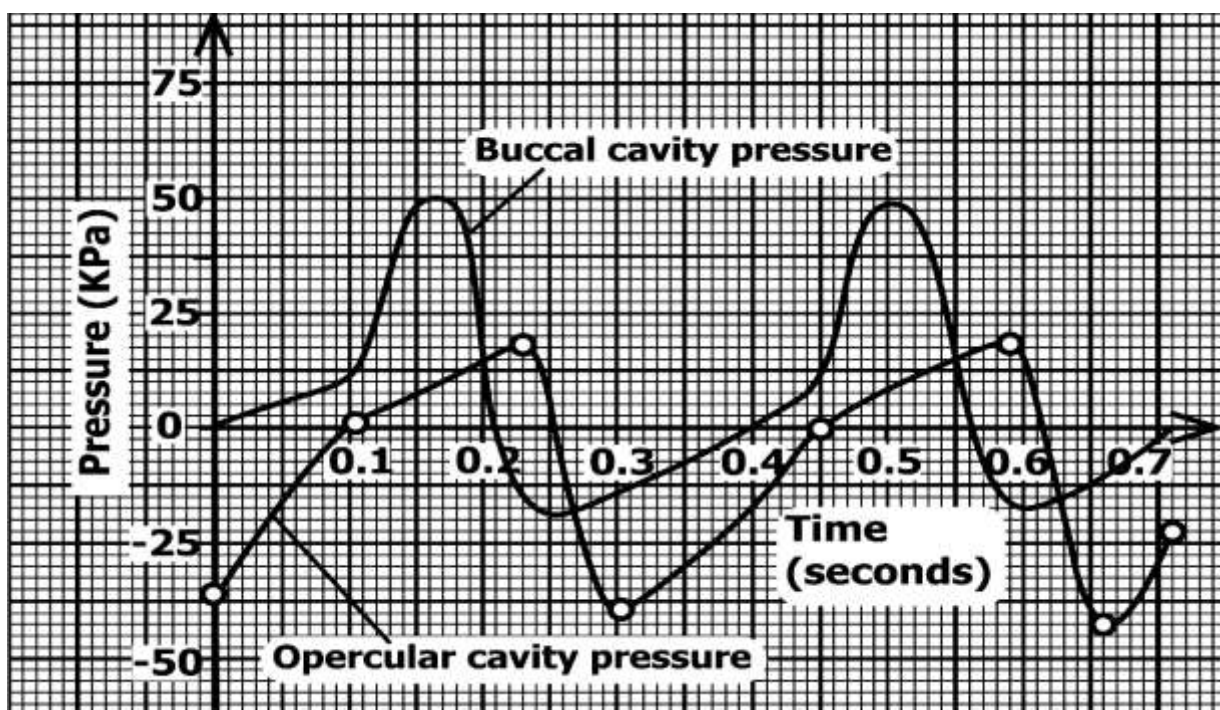


- (a) Describe the changes in the rate of carbon dioxide uptake and release for group B. (04 marks)
- (b) Compare the effect of light intensity on the rate of carbon dioxide uptake and release in the two groups of plants. (07 marks)
- (c) Explain the changes in rate of carbon dioxide uptake for group A. (08 marks)
- (d) From the graph above,
 - (i) Explain why the rate of carbon dioxide release decrease with increase in light intensity. (03 marks)
 - (ii) Explain the advantage of having a lower compensation point for group B in their habitat. (04 marks)

- (e) Suggest and explain how carbon dioxide uptake would be affected if the stems of group A were used instead. (04 marks)
- (f) Explain why each of the following were done:
- (i) Addition of sodium hydrogen carbonate to water. (02 marks)
 - (ii) Plants of the same species but grown in different habitats were used. (04 marks)
 - (iii) Same number leaf discs were used for each experiment. (02 marks)
- (g) Explain the importance of the information shown in the graph to humans. (03 marks)
- 36.** (a) Describe how chloroplasts are adapted to the process of photosynthesis. (04 marks)
- (b) Explain the events which lead to the formation of ATP and NADPH₂. (07 marks)
- (c) Explain why C₄ plants are considered to be more photosynthetically efficient than C₃ plants? (02 marks)
- (d) Explain briefly how reduced NADP formed in the light-dependent stage is used in the light-independent stage. (07 marks)

TOPIC 9: GASEOUS EXCHANGE

- 37.** Describe the process of gaseous exchange in terrestrial plants. (20 marks)
- 38.** (a). Describe the characteristics of gaseous exchange surfaces in animals. (06 marks)
- (b). Describe the ventilation mechanism in man. (08 marks)
- (c). Describe the role of brain in controlling breathing in man. (06 marks)
- 39.** Figure below shows the pressure changes in the buccal and opercular cavities of a teleost fish that were obtained using a hypodermic tubing connected to a pressure recorder.



- (a) Describe the pressure changes in the buccal cavity for the first 0.5 seconds. (07 marks)
- (b) Compare the pressure changes in the buccal cavity and opercular cavity in the first 0.4 seconds. (08 marks)
- (c) Explain the observed pressure changes in the buccal cavity and Opercular cavity from 0.2 second to 0.6 second. (12 marks)
- (d) What is the physiological significance of the observed differences between the pressures in the buccal cavity and the opercular cavity? (05 marks)
- (e) The table below summaries the features of gill lamellae of three species **A**, **B** and **C** of a teleost fish.

Species of fish	Thickness of lamellae in μm	Distance between lamellae in μm	Distance between blood and surrounding water in μm
A	20	30	6
B	12	35	3
C	7	20	1

- (i) Explain how the thickness of lamellae is related to the extent of activity in these fishes. (06 marks)
- (ii) Blood in the lamellae flows in opposite direction to that of water. Comment on the efficiency of this mechanism in

TOPIC 10: RESPIRATION

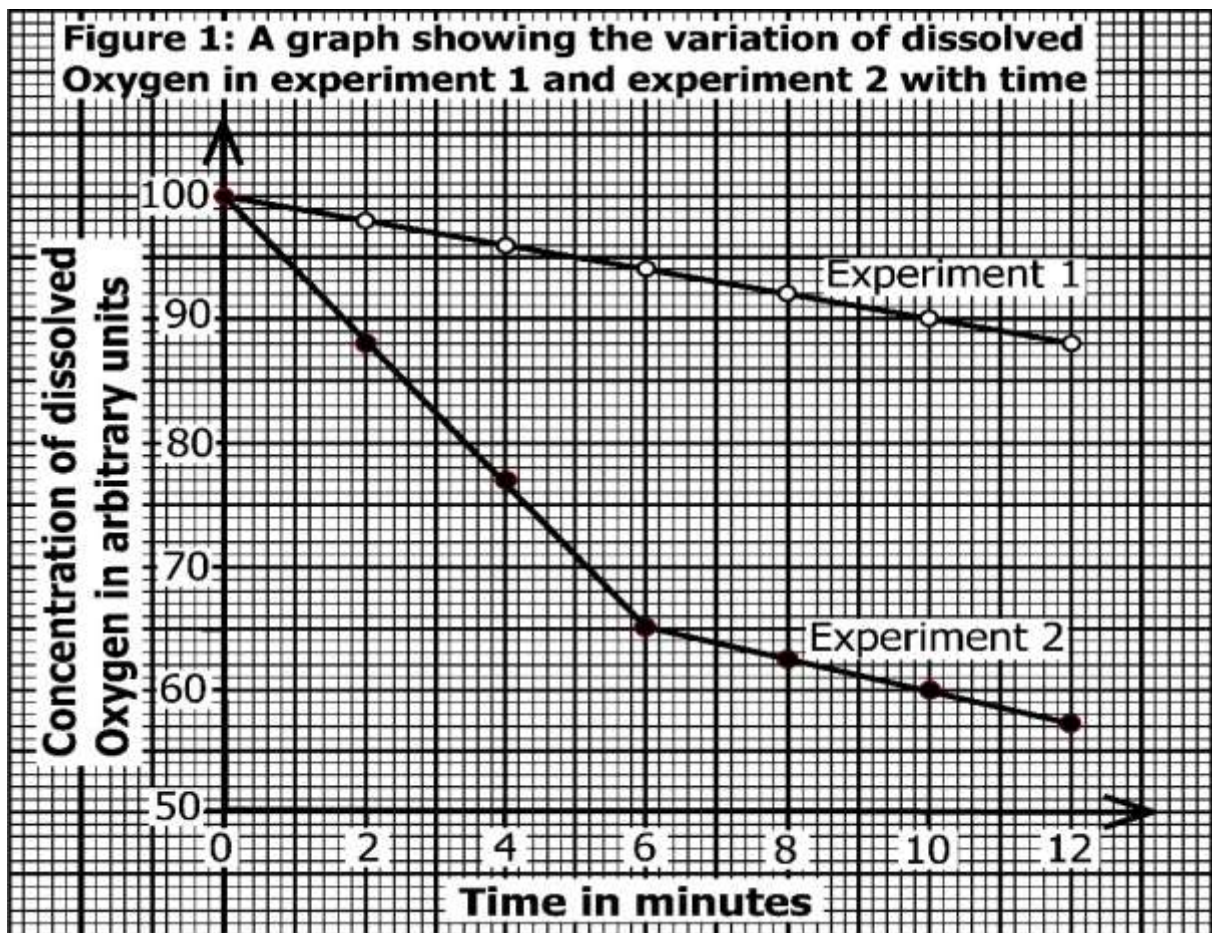
40. Three experiments were conducted, where mitochondria obtained from highly respiring muscle tissue were placed in buffer solutions and then the solution incubated at 30°C.

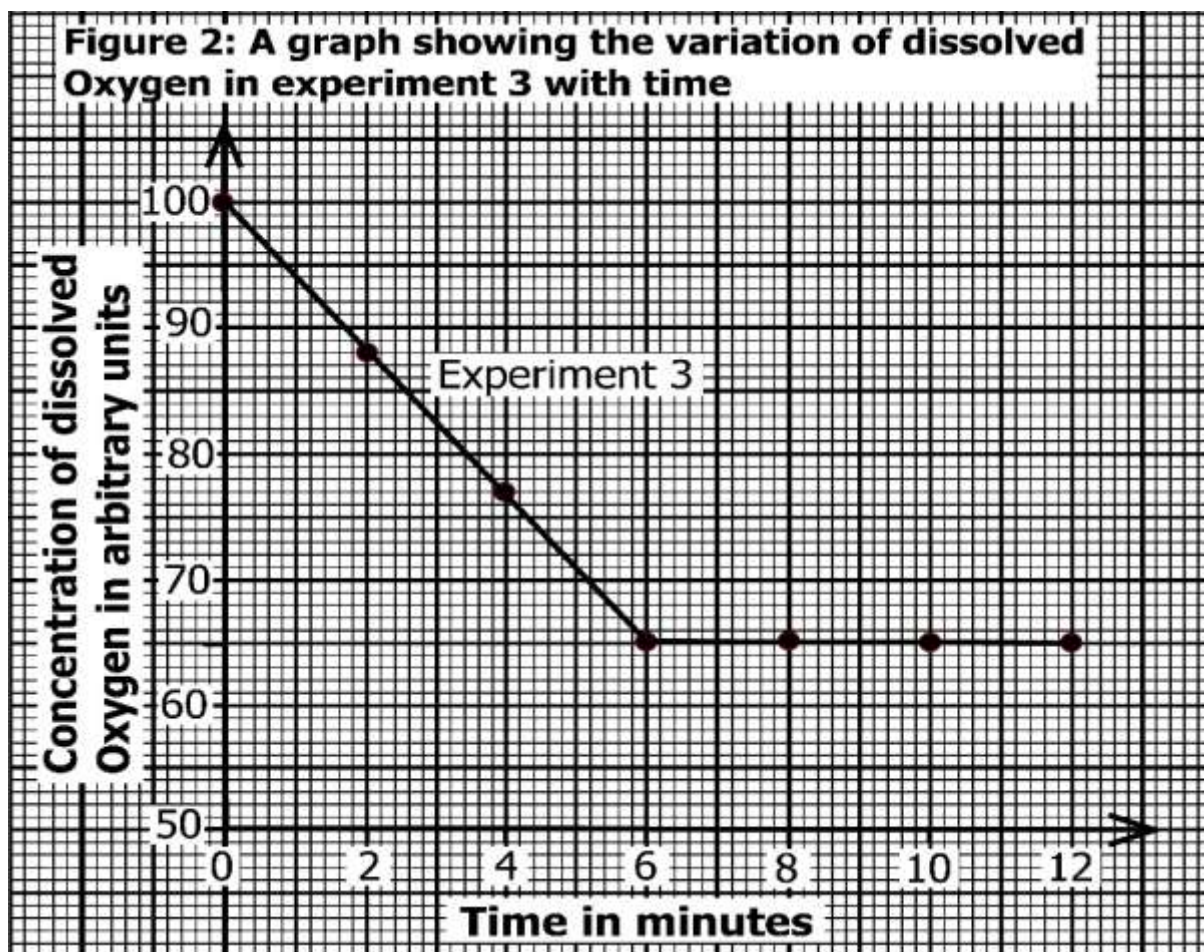
In **experiment 1**: The mitochondria were kept in buffer solution containing sucrose and inorganic salts.

In **experiment 2**: The mitochondria were kept in buffer solution into which succinate a Krebs cycle intermediate was added and malonate added 6 minutes after the experiment had begun.

In **experiment 3**: The mitochondria were kept in buffer solution into which succinate a Krebs cycle intermediate was added and sodium azide added 6 minutes after the experiment had begun.

In each of the experiments **1** to **3**, concentration of dissolved oxygen in the buffer solution was measured using electrodes and the results are shown in figures **1** to **2**.





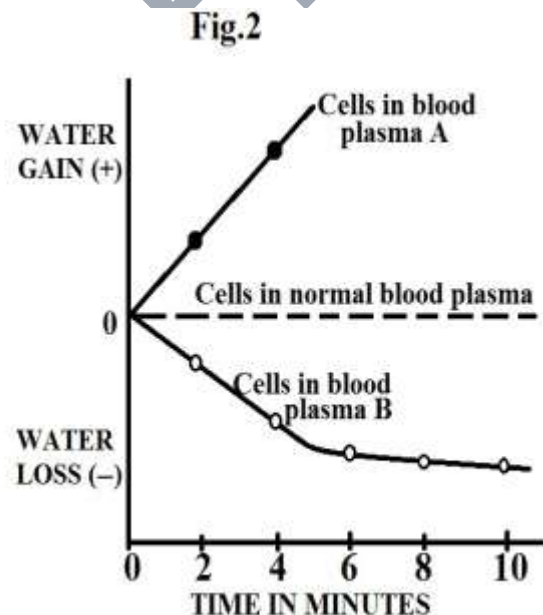
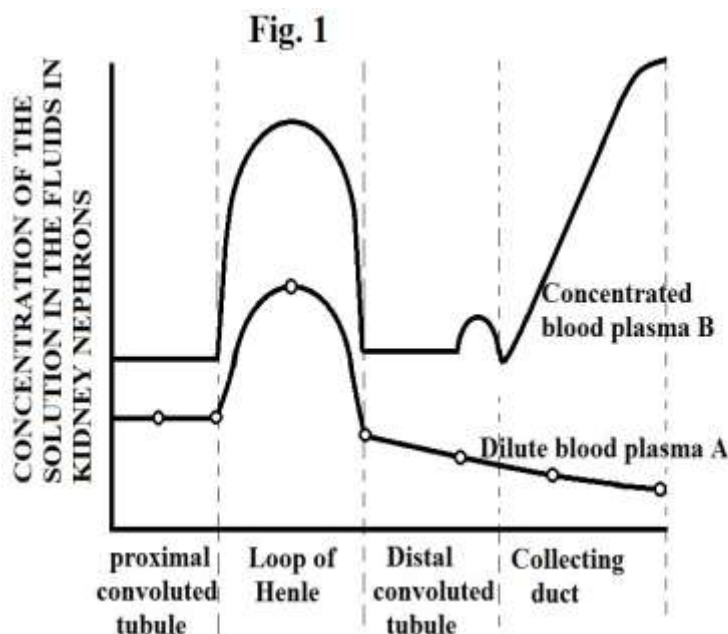
- (a) Account for the,
- Changes in concentration of oxygen in Experiment 2. (12 marks)
 - effect of adding sodium azide in experiment 3. (04 marks)
 - differences in concentration of dissolved oxygen in experiment 1 and 2. (08 marks)
- (b) Compare the concentration of oxygen in experiment 2 and 3. (04 marks)
- (c) Why were the Mitochondria used in the experiment:
- placed in buffer solution? (03 marks)
 - obtained from highly respiring tissues? (02 marks)
- (d) From the figures 1 and 2, state the factors that influenced the experiments. (03 marks)
- (e) In what ways is the energy production in the mitochondrion similar to that in a chloroplast. (04 marks)

HOMEOSTASIS

- 41.** Many of the metabolic reactions that occur in organisms produce hydrogen ions which could change the pH of the body fluids.
- Name the substances that occur in organisms that act as buffers.
 - Describe how the kidney helps to maintain the pH of blood at a constant level.
 - How is the concentration of sodium and potassium ions controlled in the body?

- 42.** **Figure 1** is a graph showing the responses of different regions of the kidney nephrons in humans who were subjected to conditions that in result in dilute blood plasma **A** and concentrated blood plasma **B**.

Figure 2 is a graph showing osmotic behaviour of red blood cells in dilute blood plasma **A**, concentrated plasma **B** and normal blood plasma in humans.



- Explain how the conditions of dilute and concentrated blood arise in human (07 marks)
- Compare the variation of concentration of solute in the fluid in the different regions of human kidney nephrons for individuals with dilute and concentrated blood plasma. (06 marks)
 - Describe the response of kidney in human's bodies to the variation in the concentration of the blood plasma as indicated in figure 2 above. (08 marks)
- Explain the differences in the osmotic behaviour of red blood cells in the three blood plasma solutions shown in figure 2 above. (12 marks)

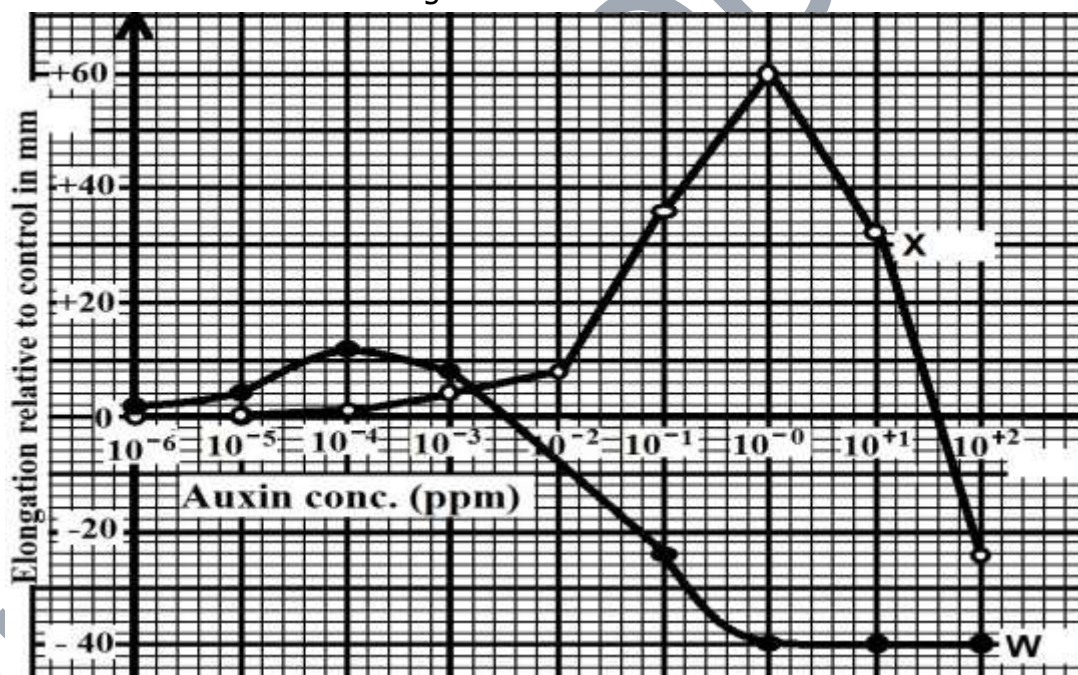
- (ii) What is the significance of the changes indicated in figure 2 in relation to the functioning of the human's blood? (03 marks)
- (d) State the factors that influence the water needs of mammalian bodies.

(04 marks)

- 43.** (a) Describe the functioning of the counter current exchange mechanism in terrestrial mammals that permit water conservation. (07 marks)
- (b) Explain physiological mechanisms of regulating mammalian core body temperatures at steady state in cold conditions. (13 marks)

TOPIC 12: COORDINATION

- 44.** The graph below shows the effect of applying different concentrations of auxins to the shoots and roots of cereal seedlings.



- (a) With reasons, name the two parts of the plant, **X** and **W**. (04 marks)
- (b) Describe the effect of different concentrations of auxin on **X** and **W** growth. (11 marks)
- (c) Compare the elongation in shoots and elongation in roots in relation to auxins concentration. (08 marks)
- (d) Account for the differences in elongation in shoots and in roots stated in (c) above. (06 marks)

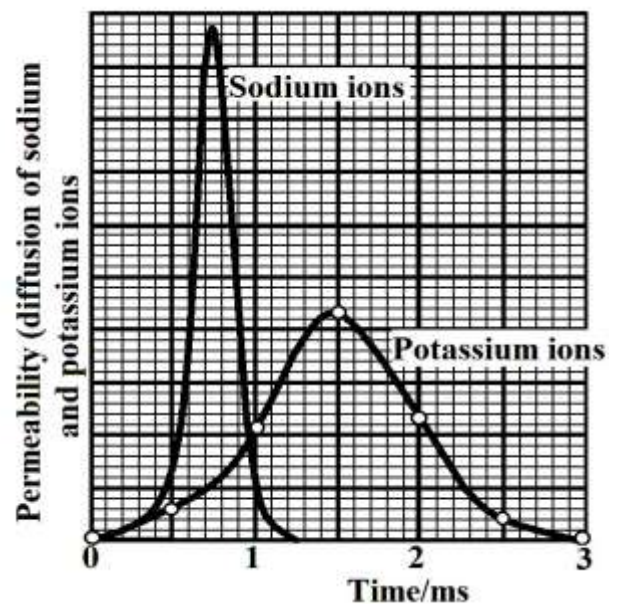
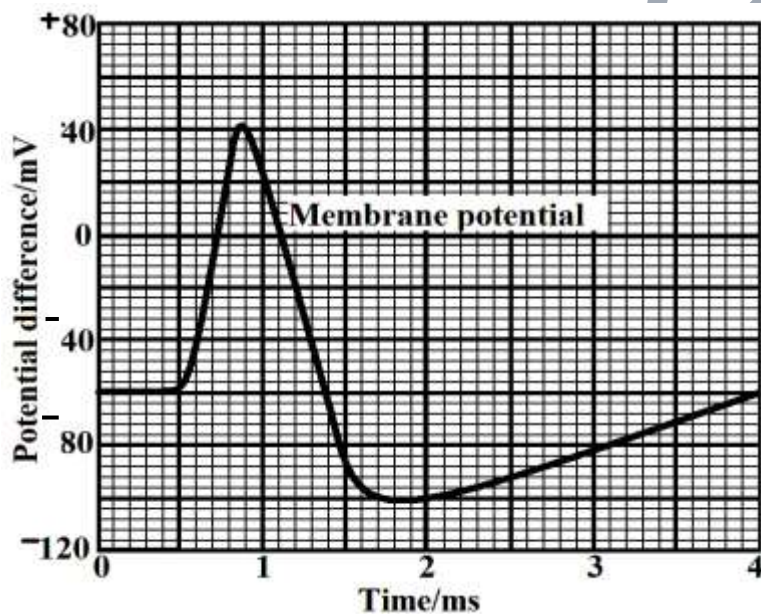
- (e) Explain the effect of auxins on the **X** and **W** of horizontally growing seedling in darkness. (07 marks)
- (f) Outline ways in which auxins have been used in improving agriculture. (04 marks)

- 45.** (a) What is **photoperiodism**? (02 marks)
- (b) Explain the effects of light and darkness on the process of flowering:
- (i). In short-day plants (08 marks)
- (ii). In long-day plants (08 marks)
- (c). Explain the effect of interrupting a short-day plant with a flash of red light at night during flowering. (02 marks)

- 46.** The **figure 1** below shows the changes in the membrane potential showing the electrical events associated with the nerve impulse in an axon. **Figure 2** shows changes in the permeability of the membrane of axon to sodium and potassium ions during transmission of an impulse which occurs very fast and rapidly.

Fig. 1

Fig. 2



- a) Compare the trend of diffusion of sodium and potassium ions across the membrane of an axon over the 3 milliseconds (ms) period. (10 marks)
- b) Using both figures 1 and 2, explain the trend of each of the following during the propagation of the impulse in the axon:
- (i) Membrane potential. (12 marks)
- (ii) Sodium ions. (05 marks)
- (iii) Potassium ions. (05 marks)

- c) In each case, state two factors which can cause rapid and slow propagation of impulse. (04 marks)
- d) Give the significance of fast conduction of impulse to organisms. (04 marks)

47. (a) Giving one example in each, state the meanings of each of the following forms of behavior:

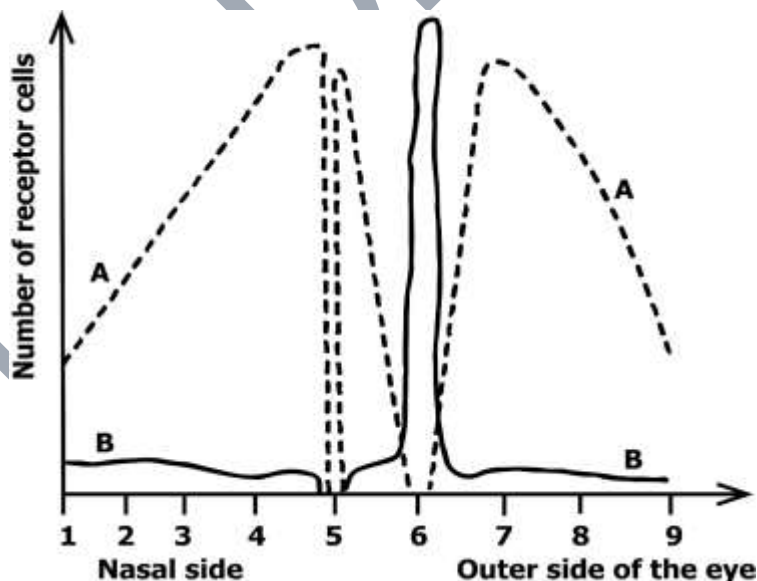
- (i) Habituation. (02 marks) (ii) Imprinting. (02 marks)
 (iii) Instinctive behavior. (02 marks)

(b) Explain the significance of each of the following forms of behavior to animals:

- (i) Territorial behavior. (04 marks) (ii) Habituation. (03 marks) (iii) Imprinting. (04 marks)
 (iv) Instinctive behavior. (03 marks)

48. The graph on the right shows the number of receptor cells (type A and B) in arbitrary units in the human retina along a horizontal line from the nasal side of the eye to the outer side of the eye.

- (a) (i) Giving reasons, identify the types of receptor cells represented by **A** and **B**. (02marks)
 (ii) Explain why there are no receptor cells at position 5. (04 marks)



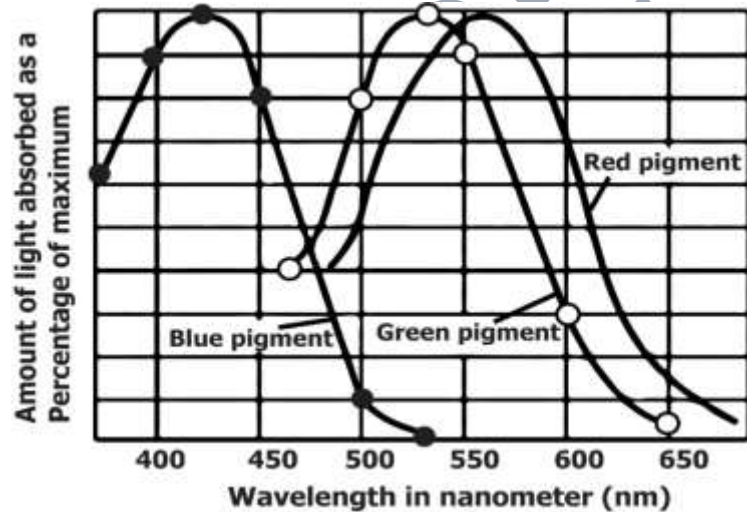
- (iii) What is the name of the region of the retina at position 6. Give a reason for your answer. (01 mark)

(b) Explain why;

- (i) the greatest concentration of receptor cells of type **B** occurs at position 6. (03 marks)
 (ii) on entering a dimly-lit room, objects in the room at first are invisible but gradually become visible. (09 marks)
 (iii) in a dimly-lit room, objects are only visible in black and white colour? (02 marks)

- (c) (i) From the graph, identify and describe the features of the receptor cells which allow colour vision. (04 marks)
- (ii) The flowers of three species of a plant are similar in form and appear to have yellow colours of petals. When photographed in ultraviolet light, each species shows a different pattern on its petals. Using this information, explain how bees are able to distinguish between the flowers of the three species, but not humans. (05 marks)

A theory of colour vision suggests that a photoreceptor has pigment that exists in three forms namely red, blue and green according to the colour of wave length absorbed by each. The absorption of different waves lengths by the three forms of photoreceptor pigments is given in the graph below. Study the graph and answer the questions that follow.



- (d) Explain why light of wave length:
- (i) 430nm appears blue. (02 marks)
- (ii) 550nm appears yellow. (02 marks)
- (iii) 570nm appears Orange. (02 marks)
- (e) Explain why two closely placed small objects can be easily distinguished by cones than rods. (04 marks)

- 49.** (a) With examples, discuss the mode of action of hormones. (12 marks)
(b) How is the secretion of aldosterone controlled? (08 marks)
- 50.** (a) Explain how an action potential is transmitted along a sensory neurone. (06 marks)
(b) Describe how a nerve impulse crosses a cholinergic synapse. (07 marks)
(c) Describe the structure of a myelin sheath and explain its role in the speed of transmission of a nerve impulse. (07 marks)
- 51.** (a) Explain the meaning of each of the following:
(i) Visual acuity. (07 marks)
(ii) Retinal convergence. (04 marks)
(b) Explain how a mammalian eye achieves each of the following:
(i) Colour perception. (04 marks)
(ii) Visual perception under very bright light. (05 marks)
- 52.** (a) Describe the characteristics of receptor cells. (06 marks)
(b) Describe the role played by each of the following in maintenance of balance in human body:
(i) Semi-circular canals; (07 marks)
(ii) Utriculus and sacculus. (07 marks)

TOPIC 13: SUPPORT AND MOVEMENT:

- 53.** (a) With the aid of labelled diagrams, describe how each of the following types of movement occur:
(i) Ciliary movement. (08 marks)
(ii) Amoeboid movement. (08 marks)

- (b) What is the importance of ciliary and amoeboid movements in humans? (04 marks)

54. (a)

Draw a well labelled diagram of a neuro-muscular junction.

(04 marks)

-
- (b) Explain how impulses are transmitted across the nerve-muscle junction. (08 marks)
- (c) Explain the important steps of sliding filament theory of muscle contraction. (08 marks)

55. (a) Describe how support is achieved in the following organisms:

- (i) Insects. (02 marks) (ii) Earthworms. (02 marks) (iii) Herbaceous plants. (02 marks)
- (iv) Trees. (05 marks)
- (b) Explain how movements and support of fish are brought about in water. (08 marks)

TOPIC 14: REPRODUCTION, GROWTH AND DEVELOPMENT

56. (a) Differentiate between **spermatogenesis** and **oogenesis**. (06 marks)

- (b) With the aid of schematic representation, explain the process of oogenesis in female human. (07 marks)
- (c) With the aid of schematic representation, explain the process of spermatogenesis in male human. (07 marks)

57. (a) Compare primary and secondary growth in plants. (05 marks)

- (b) Describe how secondary thickening occurs in a dicotyledonous plant. (07 marks)

- (c) State the importance of secondary thickening to plants. (03 marks)
- (c) Explain the hormonal control of complete metamorphosis in insects. (05 marks)

58. (a). Describe the role of the following hormones in the menstrual cycle:

- (i) Luteinizing Hormone (LH). (03 marks)
- (ii) Follicle Stimulating Hormone (FSH). (02 marks)
- (iii) Oestrogen. (02 marks)
- (iv) Progesterone. (03 marks)
- (b). Explain the role of the placenta in the development of the mammalian embryo. (10 marks)

PRACTICAL QUESTIONS

59. You are provided with **specimen T (toad)** which is freshly killed.

- a) Observe the fore and hind foot. State two observable structural differences between them. (02marks)
- b) Put the specimen ventral side uppermost on a dissecting board and pin with limbs fully stretched. Dissect to pull out the skin from the body wall and upper region of limbs.
- (i) How significant are the structure features of the hind foot to locomotion? (03 marks)
- (ii) Observe the right hind limb, draw and label the observable thigh and tibia muscles together with the remaining part of limb which should not be labeled. (04marks)
- c) Dissect the specimen to display blood vessels that;
- i) Supply blood to urinary structures and those on the upper jaw. ii) Draining blood from the right hind limb and structures responsible for chemical digestion of carbohydrates. Draw and label your dissection when the heart is undisplaced. (27 marks)

OR c) Dissect the specimen to display;

- (i) Structures for sensitivity posterior to the kidneys and those in the thoracic region.
- (ii) Blood vessels that supply structures for excretion, gonads and those draining structures for absorption of food nutrients with the heart pinned anteriorly / displaced. Draw and label your

60. You are provided with specimen **K (cockroach)**. Examine it carefully and answer the questions that follow:

- a) Place the specimen ventral side upper most spread out the wing and then examine the anterior wing and posterior wing using a hand lens.
 - (i) Give three structural differences observed between anterior wing and posterior wing. (03 marks)
 - (ii) Explain one way the structures of the anterior and posterior wing relate to their function. (02marks)
 - (iii) Cut off the left hind limb and then outline the adaptations of the structures posterior to the tibia of the hind limb that enables the animal to efficiently locomote. (03 marks)
- b) Place the specimen dorsal side uppermost, open up the abdomen by cutting along the left lateral side. Displace the alimentary canal to your left. Immerse the specimen in water fully. Draw and label all the buoyant internal structures anterior to the 6th abdominal segment. (15 marks)
- c) By further dissection, Dissect the specimen by cutting along the right lateral side of the thoracic region to expose only the structures attached on the ventral cuticle. Draw and label the exposed structures with the digestive system discarded. (10 marks)

61. You are provided with a freshly killed specimen labeled **R (rat)**

- a(i) With reference to the cover of the body, give the importance of each of the structure to the animal. (03marks)
- ii) Examine the feet of the animal, how are they adapted for its Survival in the habitat. (03marks)
- b) Dissect the specimen on the tray, cut and remove the superficial structures on the ventral surface of the neck, to display the visible neck structures previously cover. Draw and label the musculature of the neck, chest region and thoracic region. (10 marks)
- c) Open the abdomen to display vessels that carry blood
 - (i) To structures responsible for **chemical digestion** from the heart
 - (ii) From structures responsible for **secretion** and **excretion** on the left back to the heart.Draw and label your dissection excluding the heart. (24 marks)

~ END ~

MUGABI GODFREY