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**A' Level Biology Seminar**

**At Makerere University**

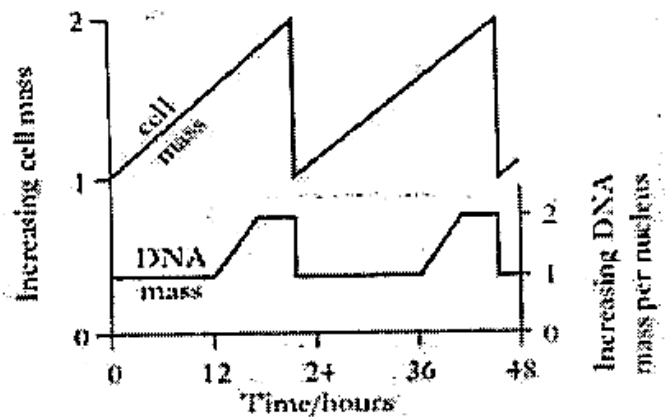
**On Sunday 24<sup>th</sup> September, 2023**

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**PART 1: THEORY QUESTIONS**

**Topic 1: Cytology and Cellular Transport**

1. Figure 1 below shows changes in the quantities of nuclear DNA and cell mass during repeated cell cycle.



- a) For one cell cycle only, describe the changes in:

(i) Mass of DNA

(02 ½ marks)

(ii) Cell mass

(01 ½ marks)

b) For one cell cycle only, explain the trend in:

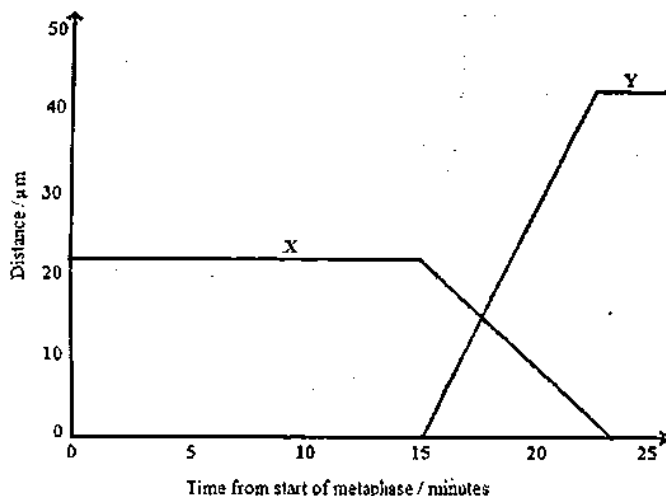
(i) Mass of DNA (08 marks)

(ii) Cell mass (08 marks)

c) Explain the significance of the observed changes in mass of DNA from 12 hours to about 23 hours.

In figure 2 below, the graphs represent changes during mitosis in the distance between:

(i) Centromeres of chromatids and pole of the cell.



d) Identify what curves X and Y represent. (01 mark)

e) Explain the trend in distance represented by:

(i) Curve X. (08 marks)

(ii) Curve Y. (07 marks)

f) Explain the variation in the maximum distance achieved in X and Y. (03 marks)

### MIDLAND HIGH SCHOOL

2. The table below shows the percentage of red blood cells haemolysed and the percentage of plasmolysed onion epidermal cells when the tissues are separately placed in a series of sucrose solutions ranging from 0.0 to 0.6 M in covered dishes at a constant temperature of 20°C

Concentration of sucrose concentration in mol/dm <sup>3</sup>	Percentage of red blood cells haemolysed	Percentage of plasmolysed onion epidermal cells
0.00	100	0
0.10	93	0

0.20	86	0
0.25	82	1
0.30	65	2
0.40	27	4
0.45	10	13
0.50	6	70
0.55	3	100
0.60	0	100

- a) (i) Represent the information graphically using the same set of axes. (08 marks)
- (ii) Describe the percentage of plasmolysed onion epidermal cells with increasing concentration of sucrose solution. (06 marks)
- (iii) Compare the percentage of red blood cells haemolysed and the percentage of plasmolysed onion epidermal cells. (05 marks)
- b) (i) From the graph, determine the concentration of the onion epidermal cells to be used to determine their solute potential. (02 marks)
- (ii) Fully explain how you arrived at your answer in (b) (i). (08 marks)
- c) Give an explanation of each of the following:
- (i) Red blood cells placed in a 0.0M sucrose solution swell and burst while plant cells do not. (06 marks)
- (ii) Fully explain how you arrived at your answer in (b) (i). (08 marks)
- (iii) Dishes containing the red blood cells or onion epidermal tissue are covered during the experiments.
- (iv) The solutions are kept at a constant temperature of 20°C during the experiments. (01 mark)

2. In an experiment, carrot discs were first washed thoroughly in pure water. The discs were then immersed in aerated potassium chloride solution of known molarity at varying temperatures. The results are given in the table below. After four hours of the experiment, the carrot discs at 25°C were treated with potassium cyanide. The absorption of potassium ions in  $\mu\text{gg}^{-1}$  of fresh carrot tissue was obtained as shown below:

Time in minutes	Potassium ion uptake in $\mu\text{g g}^{-1}$ fresh mass of carrot	
	At temperature 20°C	At temperature 25°C
0	0	0
60	90	170
120	105	300
240	130	480
300	130	500
360	130	500

- a) Represent the data graphically. (05 marks)
- b) Describe the changes in the rate of potassium ion uptake within the first hour at 25°C. (02 marks)
- c) During the 1<sup>st</sup> hour of the experiment, some K<sup>+</sup> enter the carrot disc cells passively. Suggest any two passive means of their movement. In each case, state a condition needed for their movement. (04 marks)
- d) Calculate mean rate of absorption of potassium ions at 20°C between the 2<sup>nd</sup> and 6<sup>th</sup> hour of the experiment.
- e) Explain the effects of treating the effects of treating the carrot cells with potassium cyanide on the rate of potassium ion uptake. (03 marks)
- f) Suggest;
- (i) The aim of the experiment. (01 mark)
  - (ii) Why the carrot discs were first washed in pure water. (02 marks)
  - (iii) Why the potassium chloride solution was aerated. (01 marks)
- g) Describe the mechanism of functioning of the sodium-potassium pump. (08 marks)
- h) Explain three factors that affect the rate of diffusion according to Fick's law. (06 marks)
- i) Why must transport occur across the cell surface membrane? (05 marks)

#### MAKERERE COLLEGE SCHOOL

- 4 a) Account for the negative water potential of any solution. (04 marks)
- b) Explain the changes in the water relations of a plasmolysed plant cell when inserted in a hypotonic solution. (10 marks)
- c) (i) Outline the differences between plasmolysis and wilting. (02 marks)
- (ii) State the roles of osmosis in organisms. (04 marks)

- 5 a) Describe the various ways in which the plasma membrane permits interactions with the outside environment. (06 marks)
- b) Proteins in the plasma membrane provide a wide range of functions. How are the various proteins of significance in the functioning of the plasma membrane? (14 marks)
- 6(a) Describe how carbohydrates exist within the plasma membrane. (06 marks)
- b) (i) State the roles of carbohydrates in the functioning of the plasma membrane. (03 marks)
- (ii) Explain how HIV interacts with T-cell membranes to cause immune suppression. (02 marks)
- c) Explain the functions of the plasma membrane. (09 marks)

## **Topic 2: Histology**

- 7(a) With examples, classify glandular tissues according to the mechanism of secretion. (08 marks)
- b) Explain how the structure and distribution of glandular tissues in vertebrates is related and adapted to function. **NAMUNGONA PARENTS S.S** (12 marks)
- 8.(a) How are the following tissues related to functions
- (i) Parenchyma tissues. (09 marks)
- (ii) Collenchyma tissues (03 marks)
- (iii) Sclerenchyma tissues (03 marks)
- b) State the functions of bones in animals. (05 marks)

## **Topic 3: Chemical of Life**

- 9 (a) State the comparisons between translation and transcription. (07 marks)
- b) Describe the series of events that lead to formation of a polypeptide chain from the messenger RNA molecule. (08 marks)
- c) Explain the role of translation in a cell. (05 marks)

**SSAKU SS**

- 10(a) State the structural features of carbohydrates that account for the existence of the wide variety of polysaccharides. (06 marks)
- b) With examples, outline the chief functions of monosaccharides in living organisms. (10 marks)
- c) Explain why cells of poikilothermic animals usually have a higher proportion of

unsaturated fatty acids than homeothermic animals.

(04 marks)

11(a) With suitable examples, classify enzymes based on the reactions they catalyse.

(09 marks)

b) State the general characteristics of the active sites of different enzymes. (06 marks)

c) Describe the mechanism of enzyme action based on the induced fit model.(05 marks)

#### **Topic 4: Genetics**

12. In a laboratory population of diploid, sexually reproducing organisms a certain trait was studied. This trait is determined by a single autosomal gene and is expressed as two phenotypes. A new population was created by crossing 51 pure breeding (homozygous) dominant individuals with 49 pure breeding (homozygous) recessive individuals. The table below shows the results obtained after four generations.

Generation	NUMBER OF INDIVIDUALS		
	Dominant	Recessive	Total
1	51	49	100
2	280	0	280
3	240	80	320
4	300	100	400
5	360	120	480

a) Identify and explain the choice of organism used to perform this experiment. (03 marks)

b) On the basis of the data in the table, suggest explanation for the change in the phenotypic frequency between the first and third generations. (07 marks)

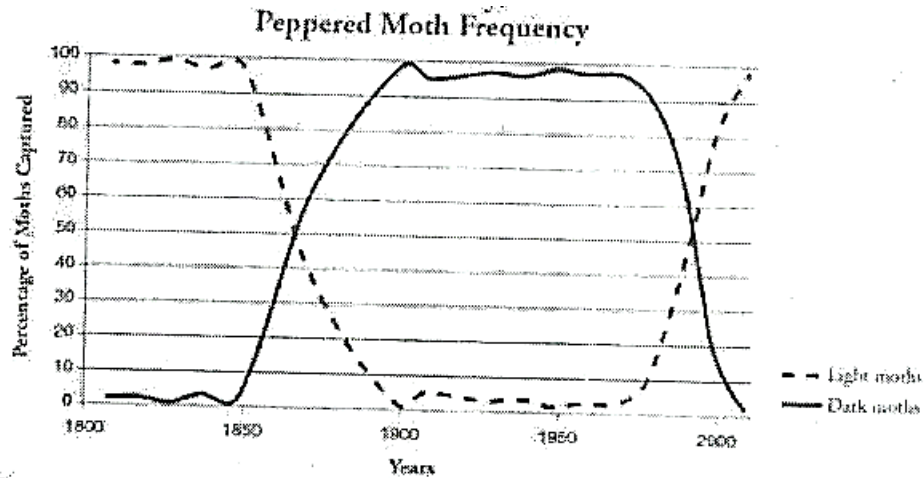
c) Explain whether or not this population is in Hardy-Weinberg equilibrium. (05 marks)

d) Explain the type of selection in operation from the information given. (03 marks)

e) Describe the evolutionary mechanism that cause change in distribution of root length.

(04 marks)

The graph below shows the change in frequency of two varieties of peppered moths in an urban center, from the period of industrial revolution to the 21<sup>st</sup> century.



f) Describe the changes in peppered moth frequency for the period shown. (05 marks)

g) Explain the observed changes in peppered moth population for the period given.

(13 marks)

**MBOGO COLLEGE SCHOOL**

13(a) How is sex determined in humans?

(04 marks)

b) A woman has four sons, one of whom is a hemophiliac and the other three are normal.

(i) What are the possible genotypes of the woman and her husband? (12 marks)

(ii) Is it possible for the couple to have a hemophiliac daughter? Explain your answer.

(04 marks)

14(a) Explain the meaning of the following:

(i) Genetic isolation.

(02 marks)

(ii) Reproductive isolation.

(02 marks)

b) Explain how the gene frequency of population may be altered.

(16 marks)

15. In *Drosophila*, the gene for wing length and shape of the abdomen are linked. The gene for long wing and broad abdomen are dominant over those for vestigial wings and narrow abdomen.

a) Work out the phenotypes resulting from a cross between a vestigial winged and broad abdomen male and a homozygous long winged and narrow abdomen female fly in the;

(i)  $F_1$  generation.

(06 marks)

(ii)  $F_2$  generation.

(04 marks)

b) A cross between a female from the F<sub>1</sub> generation in (a)(i) with a vestigial winged and narrow abdomen male fly gave the following results;

Long winged narrow abdomen flies = 35

Long winged, broad abdomen flies = 17

Vestigial winged and narrow abdomen flies = 36

Vestigial winged, broad abdomen flies = 18

Account for the phenotypes and their relative numbers in the cross. (05 marks)

c) Explain why *Drosophila* are commonly used in genetic experiments. (05 marks)

### **Topic 3: Evolution**

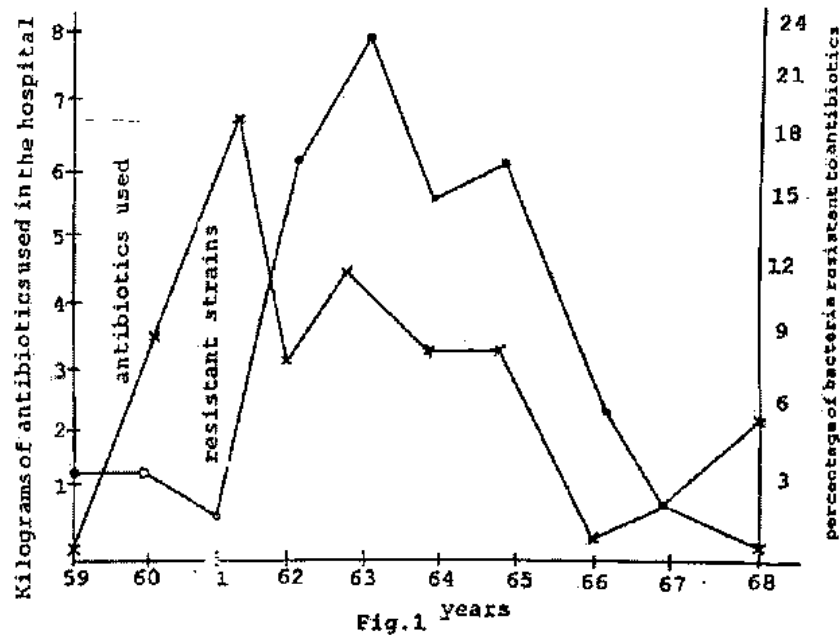
16. Table 1 shows the number of individuals with a given length of fur in a population of terrestrial mammalian species for two different generations. The prevailing climatic temperature during the two generations changed from 15°C and 10°C

**Table 1**

Length of fur (cm)	Number of individuals	
	At 15°C	At 10°C
1.00	0	0
1.25	25	0
1.50	60	0
1.75	120	20
2.00	155	60
2.25	120	130
2.50	60	130
2.75	25	130
3.00	0	60
3.25	0	20
3.50	0	0

Figure 1 shows the variation of resistant strains of bacteria in relation to the amount of antibiotics given during a period of several years in one hospital





- a) Draw a graph of the relationship between fur length and number of individuals at the two temperatures.
- b) What is the optimum length of fur at each temperature?
- c)(i) What is the effect of temperature on fur length among the individuals?  
(ii) Suggest an explanation for the effect of temperature on fur length.
- d)(i) From figure 1, describe the trend of resistant strains with the amount of antibiotics used.  
(ii) Suggest an explanation for the observed trend of resistant strains with the amount of antibiotics used.
- e) A bacterium is a haploid organism that reproduces asexually by fission, twice every minute on average. Using this information, explain the rapid emergence of resistant strains.
- f) The data in table 1 and figure 1 illustrate the process of natural selection. State the selection pressure in each case.
- g) Giving a reason in each case, predict what the effect of the following would be
  - (i) if the use of antibiotics was stopped for a year.
  - (ii) If the generation of the terrestrial mammal at a prevailing temperature of 10°C was supplied with an abundance of food.

**KAWEMPE MUSLIM S.S**

**17. (a)** Describe how abnormal hemoglobin arises in the human population

b) Explain;

- (i) the effect of the gene for abnormal hemoglobin in the human population.
- (ii) Why people with sickle cell trait do not suffer from malaria.
- (iii) Why sickle cell mutation causes hemoglobin to clump.

**KAWANDA SS**

**18. (a)** Describe the different forms of natural selection.

b) Explain how the following may lead to evolution of new species

- (i) Increased population size.
- (ii) Isolation.

**19. (a)** Explain what is meant by;

- (i) Polyploidy
- (ii) artificial selection

b) Explain how polyploidy arises in sexually reproducing organisms.

**20.** Explain the five major evidences that support the theory of evolution.

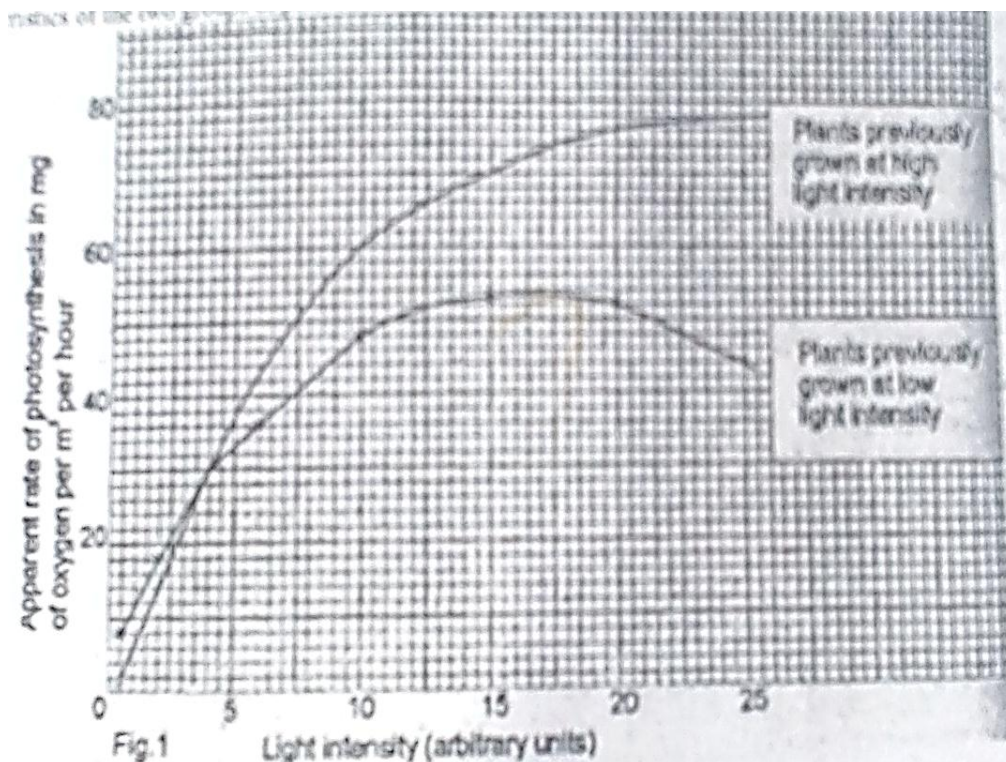
**21. (a)** Giving examples, explain the effect of;

- (i) Increased selection pressure on a population.
- (ii) Stabilizing selection pressure on population.

b) Explain how comparative anatomy supports the process of evolution.

#### **Topic 4: Nutrition**

**22.** In an experiment to determine factors affecting photosynthesis, seedlings of a plant were divided into two groups and grown under different light intensities. One group of seedlings was grown at constant high light intensity (25 arbitrary units), and another group grown at a constant low light intensity (3 arbitrary units). When the plants were mature, their apparent rates of photosynthesis in milligrams of oxygen released per unit leaf area per hour, were measured over a range of different light intensities. Fig.1 shows the results of the experiment. In addition, some characteristics of the two groups of plants were recorded as indicated in table 1.



**Table 1**

Group of plants	Characteristics
Plants grown at high light intensity	Big, dark green leaves with short internodes
Plants grown low light intensity	Small, pale yellow leaves with long internodes

a) From the graph, state the:

(i) Differences in the effect of light intensity on the two groups of plants (08 marks)

(ii) similarities in the effect of light intensity on the two groups of plants. (03 marks)

b) Suggest explanations for the differences you have stated in a(i) above. (08 marks)

c) Explain the pattern of the curve for plants grown in low light intensity. (06 marks)

d) Explain the observed characteristics of the two groups of plants as shown in Table 1. (09 marks)

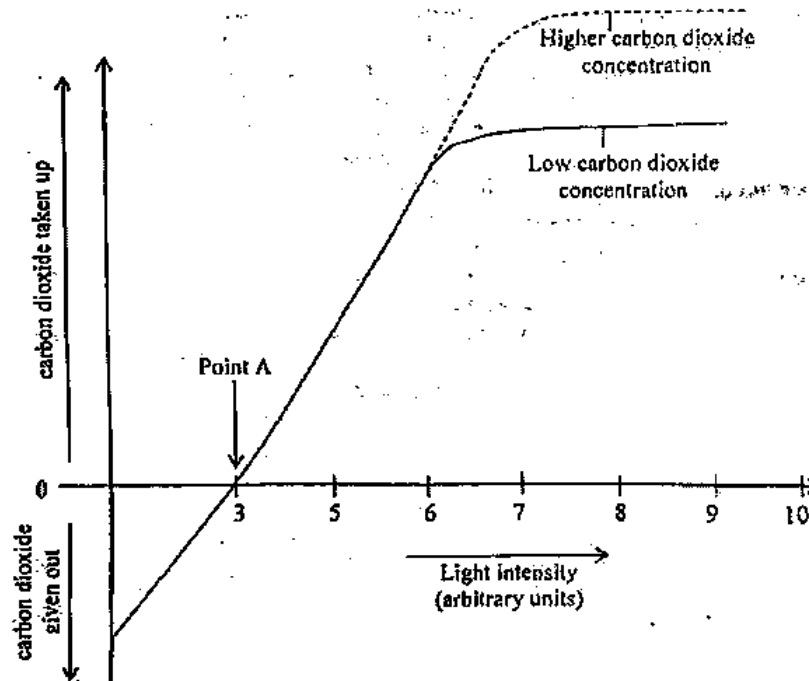
e) Suggest why:

(i) seedlings of the same plant were used in the experiment. (02 marks)

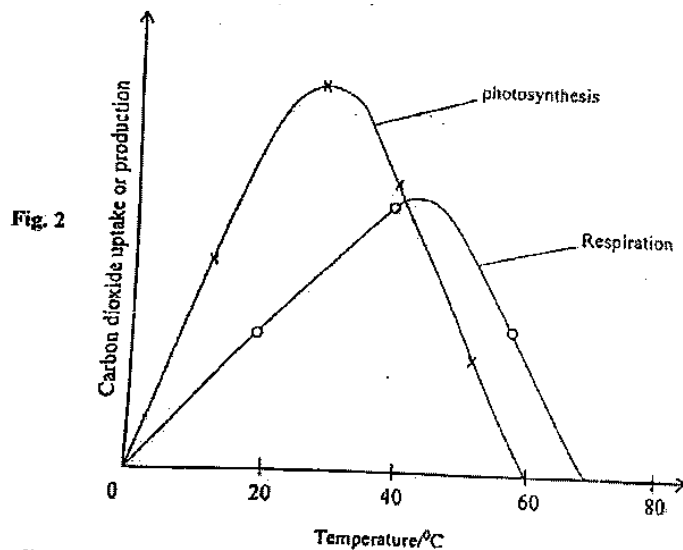
(ii) the rate of release of oxygen was used to measure the rate of photosynthesis. (02 marks)

f) Name two factors that may limit the rate of photosynthesis of plants previously grown in high light intensity, if subjected to light intensity above 25 arbitrary units. (02 marks)

23. The graph in figure 1 below represents the rate of photosynthesis as measured by the amount of carbondioxide exchanged at low carbondioxide concentration and at higher carbondioxide concentration with varying light intensity. Study it and use it to answer the questions that follow.



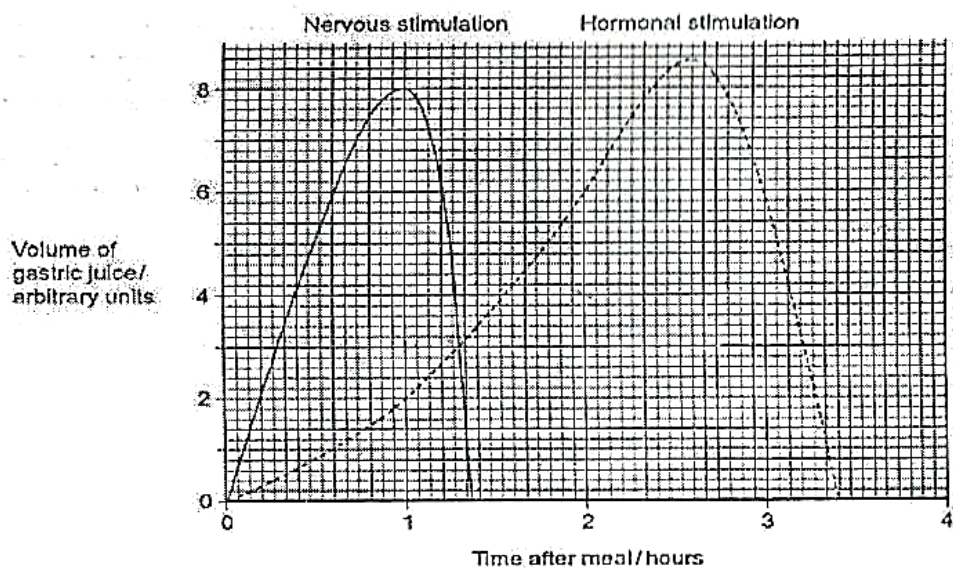
- Describe the rate of photosynthesis at low carbondioxide concentration. (08 marks)
  - Explain your description above.
- Give one difference between higher carbondioxide concentration and low carbondioxide concentration.
- Use the graph above to explain why environmentalists recommend afforestation as a mode of reducing global warming. (04 marks)
- Name point marked A on the graph and explain what occurs at this point. (02 marks)
  - Suggest and explain what would happen to a point A if instead a shade plant was used.
- Figure 2 below is a graph showing effect of temperature on the rate of photosynthesis and respiration in well illuminated leaves. (light and other variables kept constant)



- (i) Compare the effect of temperature on the rate of photosynthesis and respiration.
  - (ii) Suggest a possible reason why the rate of respiration is less affected by temperatures above 40°C than the rate of photosynthesis.
  - (iii) What would be the effect of rise in temperatures on the rate of photosynthesis if the intensity of light falling on the leaf was very low?
- (03 marks)

#### AFRICANA MUSLIM HIGH SCHOOL

**24.** Cells in the stomach wall release gastric juice after a meal. The graph shows how the volumes of gastric juice produced by nervous stimulation and by hormonal stimulation change after a meal.



- a). (i) Compare the changes in volume of gastric juice shown by the two curves.
- (ii) Describe the evidence from the graph that curve A represents the volume of gastric

juice produced by nervous stimulation.

(iii) How are the changes shown by the graph brought about?

b) The table summarizes mechanisms of control of release of digestive secretions along different parts of the gut.

Part of gut	Control mechanism
Mouth	Nervous only
Stomach	Both nervous and hormonal
Ileum	Hormonal control only

i) Discuss the variation in the trend of control of release of digestive secretions.

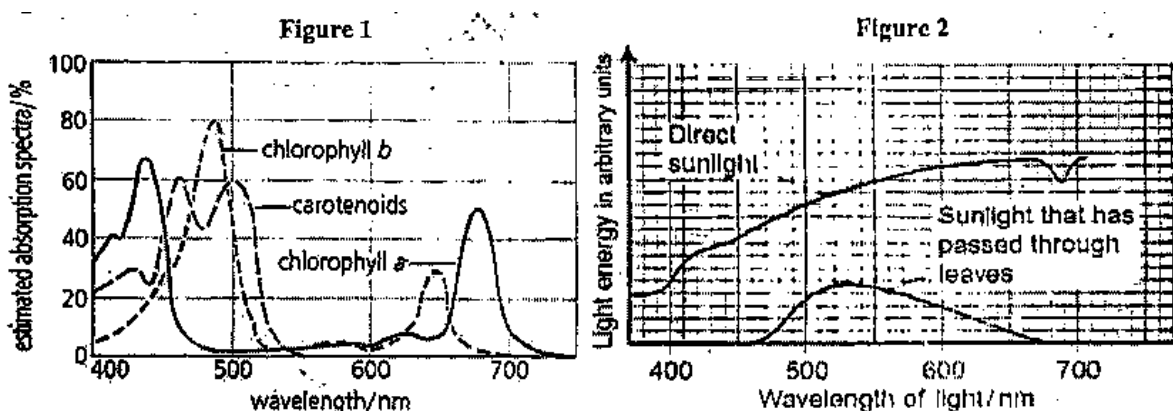
c) Explain why release of digestive secretions in man should be controlled.

### BUWAMBO SEED S.S

25. Chlorophylls and carotenoids are plant pigments that absorb light for photosynthesis. Different species of plants contain different amounts of these pigments. The pigments that each plant species has are adaptations to where and how they live their ecological niche.

Figure 1 shows the absorption of light of different wavelengths by chlorophyll a, chlorophyll b and carotenoids. Another study was carried to show the amount of energy in light of different wavelengths reaching the ground in the forest. The energy was measured in direct sunlight and sunlight that had passed through the leaves of the trees.

Figure 2 shows the result of the study



Sun leaves and shade leaves are two different kinds of leaves on beech trees. Sun leaves grow on branches exposed to direct sunlight; shade leaves grow on branches exposed to light that has passed through leaves. An ecologist collected sun leaves and shade leaves

from beech trees and determined the mean mass of each photosynthetic pigment in both types of leaf. The results are as shown in figure 3 below.

Photosynthetic pigment	Mean mass of each pigment per m <sup>2</sup> of leaf area/ micrograms	
	Sun leaves	Shade leaves
Chlorophyll a	299.3	288.9
Chlorophyll b	90.7	111.1
Carotenoids	0.10	0.07

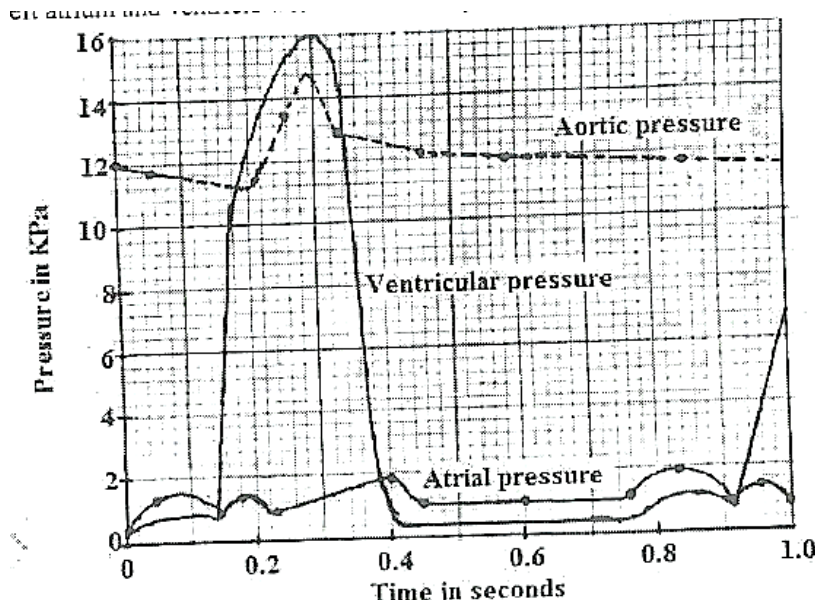
- a) Plot a suitable graph to represent the data in figure 3 above
- b) Describe the absorption of light of different wavelength by chlorophyll. (08 marks)
- c) Comment on light absorption of different wavelengths by chlorophylls and carotenoids. (06 marks)
- d) Explain:
- (i) The advantage of producing more chlorophyll b in shade leaves to beech trees. (03 marks)
- (ii) Why in leaves at the top of trees in a forest, CO<sub>2</sub> is often the limiting factor for photosynthesis. (02 marks)
- f) Each type of pigment is produced by a specific enzyme-controlled pathway. Suggest how the same plant can produce more pigment in some leaf cells than others. (02 marks)
- g) Suggest the morphological adaptations of plants for shady environments. (08 marks)
- (i) Explain the other significance of carotenoids to the beech tree besides trapping light. (02 marks)

#### MAKERERE HIGH SCHOOL MIGADDE

26. (a) Outline the different digestive juices and the roles they play. (05 marks)
- b) Discuss the nervous and hormonal control of digestion in: (15 marks)
27. (a) Describe the significance of pigments and light in photosynthesis. (12 marks)
- b) How does altitude affect the distribution of C<sub>3</sub> and C<sub>4</sub> plants? (08 marks)

## **Topic 5: Transport**

28. Figure 1 below shows the changes in the pressure that takes place within the atria, ventricle and aorta during one cardiac cycle. The left atrium and ventricle were used to easily relate their pressure changes with that of the aorta.



a) Using figure above;

- (i) Calculate the heart rate in beats per minute. Show your working. (02 marks)
- (ii) Determine how long is the valve between the left atrium and the left ventricle closed? Explain how you arrived at your answer. (02 marks)
- (iii) Describe the changes in aortic pressure in a single heartbeat. (06 marks)

b) Explain the significance of the differences in the following pressure changes.

- (i) Atrial pressure and ventricular pressure. (08 marks)
- (ii) Aortic pressure and ventricular pressure. (09 marks)

c) What is the effect of changes in ventricular pressure on the volume of ventricles?

(05 marks)

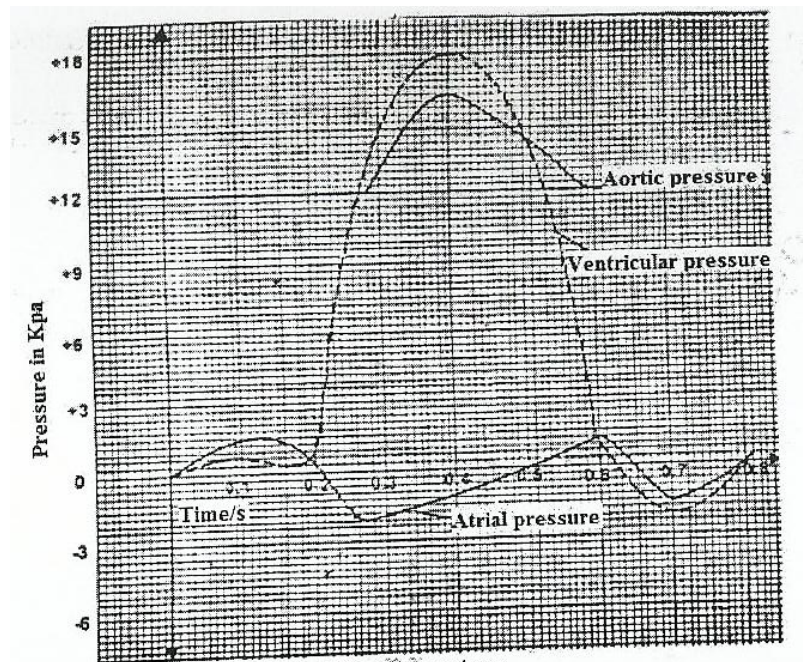
d) Suggest reason(s) for the difference in pressure in the right ventricle and that in the left ventricle of the heart. (04 marks)

e) State the adaptations of the heart to its function(s)

**KYADDONDO S.S MATUGGA**



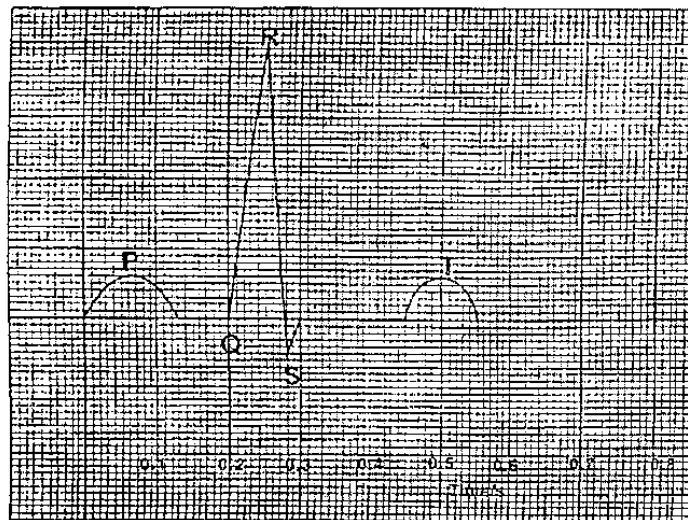
29. The graphs below show changes in pressure within the atria, ventricle and aorta during one cardiac cycle. The left atrium and ventricle were used to easily relate their pressure changes with that of the aorta



Study the information carefully and answer the following questions:

- a) Compare the changes in pressure during the cycle for each of the following
  - (i) atrium and ventricle (06 marks)
  - (ii) aorta and ventricle (06 marks)
- b) Explain the changes in pressure during the cycle for the;
  - (i) atrium and ventricle (08 marks)
  - (ii) aorta and ventricle (08 marks)

The figure below is for the electrocardiogram, of a health human being at rest



c) Describe the changes in the heart during its excitation that leads to the following;

(i) P wave

(ii) QRS complex

(iii) T wave

(08 marks)

d) Explain the statement “heart muscle contraction is myogenic” and point out the significance of this in heart transplantation surgery. (04 marks)

30. (a) Describe the events of the cardiac cycle. (10 marks)

b) Explain how the heart action is controlled? (07 marks)

c) Explain what will happen to the heart when the vagus nerve is cut? (03 marks)

31. (a) Discuss the factors that may alter the rate of heart beat in mammals. (10 marks)

b) What is the physiology of Bohr effect in animals? (08 marks)

c) Explain why according to the mass flow hypothesis, translocation can only take place in living phloem.

32. (a) State the ways by which flowering plants obtain nutrients and water. (05 marks)

b) Describe the pathways and mechanisms by which water moves right from roots to the leaves. (15 marks)

JANAN

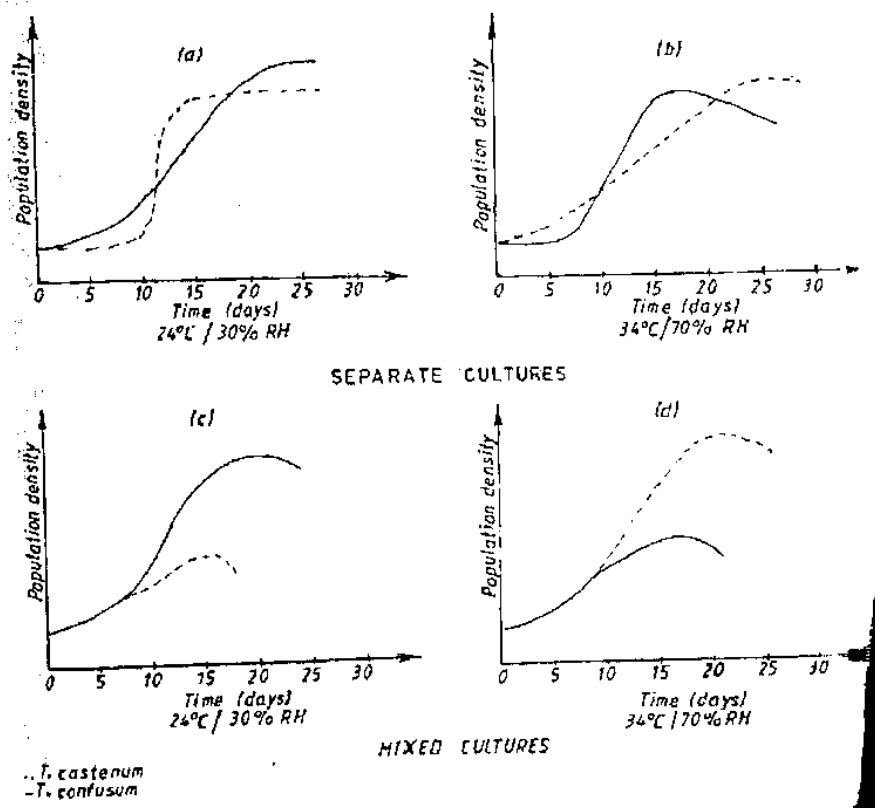
S.S

BOMBO

## **Topic 6: Ecology**

33. Two laboratory experiments to study the population growth of two species of flour beetles (*Tribolium castenum* and *T. confusum*) that were carried out under two sets of conditions of temperature and humidity. In the first experiment, the two species were cultured separately at 24°C and 30% relative humidity and 34°C and 70% relative

humidity. In the second experiment the beetles were cultured together under similar temperature and relative humidity conditions as in the first. The results obtained in experiment 1 are shown in figure 1 (a) and (b), and those obtained in experiment 2 are shown in figure (c) and (d). Study the figure and answer the questions that follow.

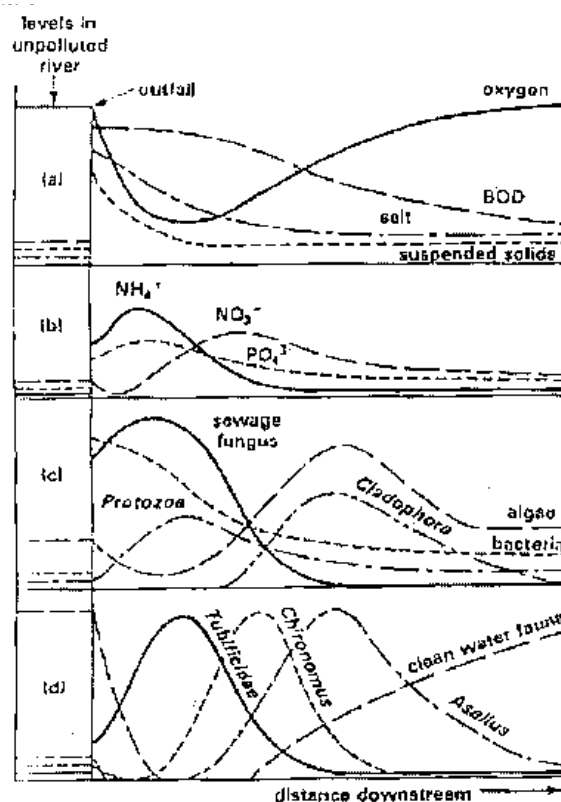


- What is the effect of raising temperature and relative humidity on the population growth of the beetles in experiment 1?
- Explain the interaction of the two species of beetles in experiment 2?
- Explain why the population of the beetles in experiment 1 level off.
- Suppose experiment 2 was to continue running for a few more days, suggest with reasons what would happen to the populations of the beetles?
- How do the results of these two experiments relate to a natural ecosystem?

34. The graphs below were obtained in a study on the effect of sewage discharge into a river. Graph A and B show physical and chemical changes.

Graph C shows changes in micro-organisms

Graph D shows changes in aquatic invertebrates



- What is meant by the term biochemical oxygen demand (BOD) and how is it measured?
- Explain the changes in BOD shown in the diagram?
- Describe the changes in the:

- physical and chemical components
- micro-organisms
- Aquatic invertebrates

**ST. JUDE MASAKA S.S**

**35.(a)** What are chemoheterotrophic bacteria?

- Give three groups of the type of bacteria in (a) above
- Using examples in each case, explain the ecological importance of each of the groups in above in an ecosystem.
- How do nitrogen fixing bacteria differ from round worms in their relationship with host?
- What is the economic importance of nitrogen fixing bacteria?
- (ii) Explain the different ways by which nitrogen enters into an ecosystem

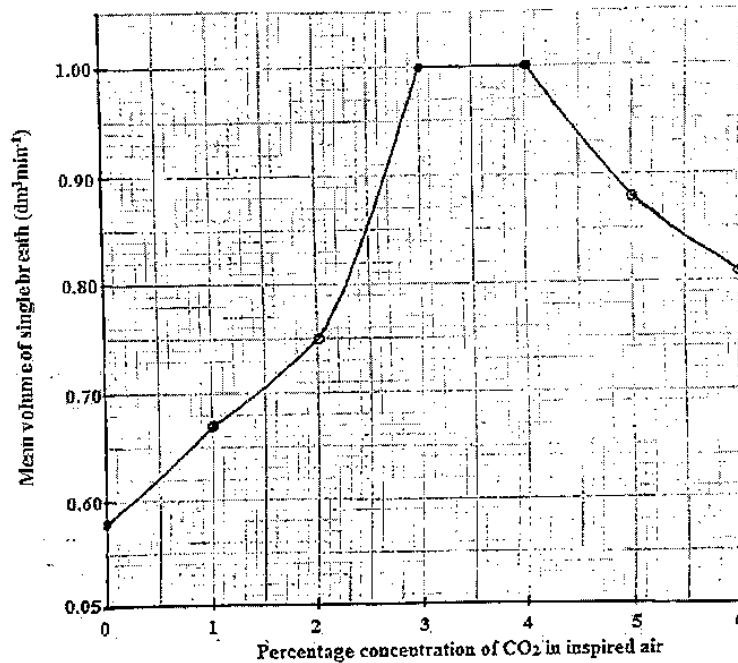
**MITA COLLEGE SCHOOL**

**36.** Write short notes on the following ecological concepts

- Ozone depletion
- Greenhouse effect and global warming

- c) Acid rain
- d) Biomagnification

## **Tropic 7: Gaseous Exchange and Respiration**

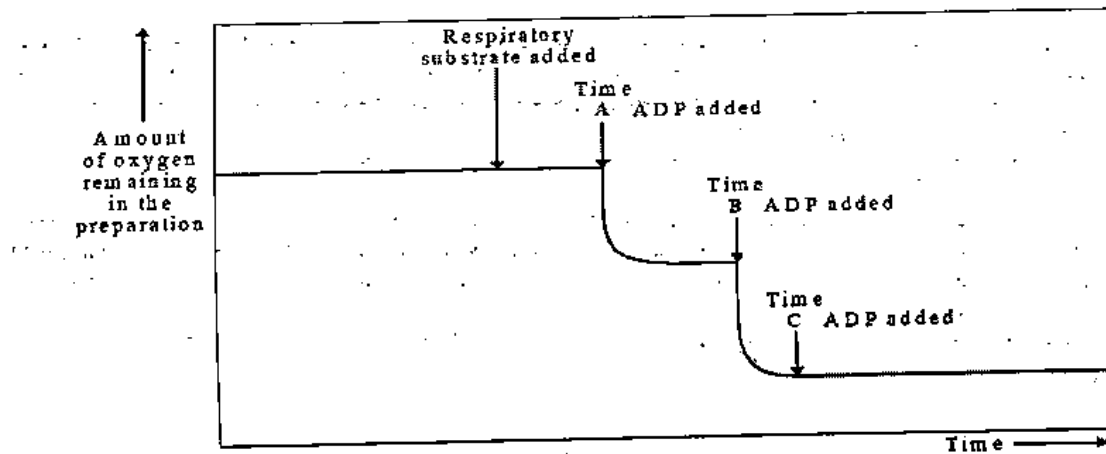


- c) Describe the effect of the increase in carbondioxide concentration in inspired air on the
  - (i) Volume of air breathed in and outer minute
  - (ii) Breathing rate.
  - (iii) Mean volume of a single breath in and out
- d) Explain the effect of the increase in carbondioxide concentration in inspired air on the
  - (i) Volume of air breathed in and out per minute
  - (ii) Breathing rate
  - (iii) Mean volume of a single breath in and out
- e) Outline the physiological effects in the body, of breathing in excess
  - (i) Carbondioxide
  - (ii) Oxygen

**MBOGO HIGH SCHOOL**

37. A preparation of mitochondria was made from liver tissue. Substances were added to this preparation and the amount of oxygen in the preparation was monitored over a period

of time. The diagram shows the trace obtained and the times when the different substances were added.



- Suggest why the respiratory substrate added to this preparation was a molecule from Krebs cycle and not glucose. (04 marks)
- What additional substance, other than those mentioned on the diagram, would need to be added to this preparation in order to get the results shown? (02 marks)
- Explain:
  - why the amount of oxygen fell between lines A and B. (03 marks)
  - the shape of the trace after time C. (02 marks)

**BAPTIST HIGH SCHOOL**

- (i) Compare the efficiency of air over water as a gaseous exchange medium. (04 marks)
  - (ii) Give two reasons why mammals need lungs rather than exchanging gases via skin. (02 marks)
- b) Describe the tracheal system of an insect. (08 marks)
  - c). How does ventilation and gaseous exchange occur in a terrestrial insect?(08 marks)

**OXFORD MUSLIM HIGH SCHOOL**

- 39.(a) What is meant by oxidative decarboxylation? (03 marks)
  - b) Explain the mechanisms leading to formation of ATP that occurs involving the inner mitochondrial membrane. (10 marks)
  - c) Describe the respiratory metabolism of glycerol in the cytoplasm of the cell. (07 marks)
- 40.(a) Describe the structure and modifications of the features of the mitochondrion that

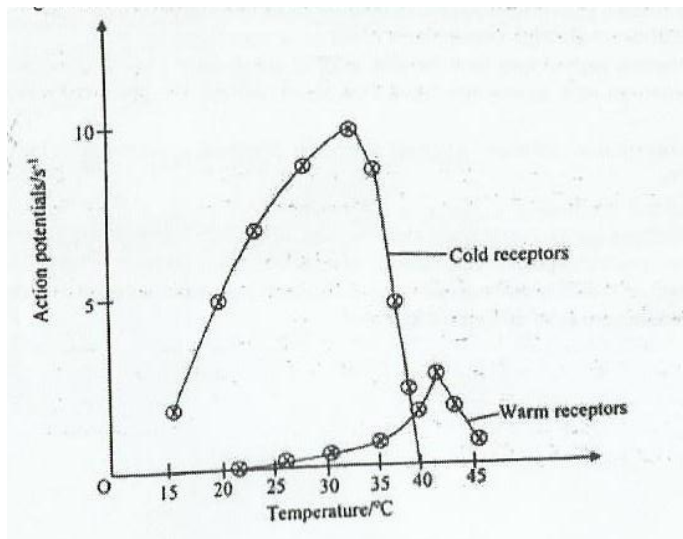
suits their functions.

- b) Explain mechanisms which lead to formation of ATP molecules that occurs involving inner membrane of the mitochondrion. (14 marks)

## **Topic 8: Homeostasis Excretion, Osmoregulation & Temperature**

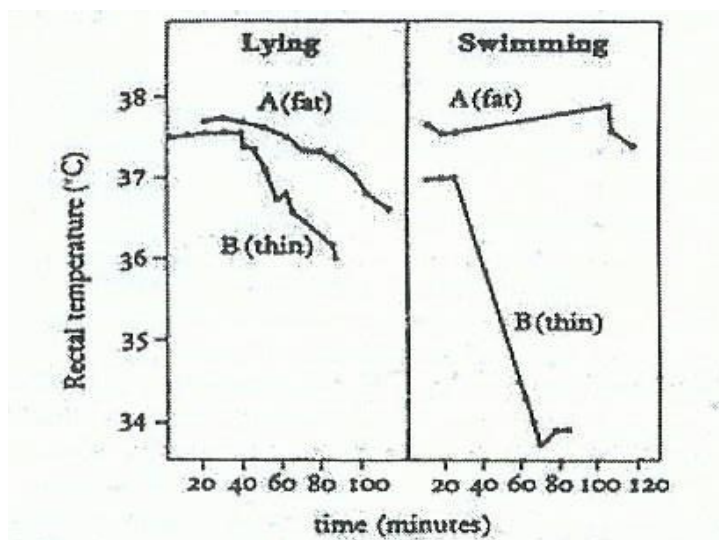
### **Regulation**

41. An experiment was conducted to measure action potentials generated by cold and warm receptors found in the skin of a mammal. Study the figure below and answer the questions that follow.



- a) Describe the response of the receptors with change in temperature. (05 marks)
- (i) Cold receptors (05 marks)
  - (ii) Warm receptors (04 marks)
- b) Explain the response of the receptors to changing temperature
- (i) Cold receptors (08 marks)
  - (ii) Warm receptors (08 marks)
- c) Suggest how the response of the receptors would vary with changing temperature if;
- (i) The organism was sprayed with water before the experiment. (05 marks)
  - (ii) The organism was given iced water before the experiment. (04 marks)
- d) Outline the responses of mammals towards increasing environmental temperature. (04 marks)
- e) State the advantages of endotherms over ectotherms. (05 marks)

42. Figure 1 below shows the results of an experiment on the body temperature of two human subjects, A and B. A is fat whereas B is thin, both subjects had their body temperature recorded at intervals while immersed in water at  $10^{\circ}\text{C}$ . Results obtained first with the subjects lying still and then while the subjects were swimming.



a) (i) From the figure above, state any two factors that affect body's ability to regulate body temperature of an individual. (02 marks)

(ii) Describe the effect of change in each of the factors above on the rectal temperature.

(iii) Give an explanation for the results described in a(ii) above. (15 marks)

b) Explain;

(i) Why rectal temperature and not skin temperature was used in the experiment.

(04 marks)

(ii) The effect of increasing water temperature to  $25^{\circ}\text{C}$ .

(03 marks)

(iii) Why prolonged exposure to severe cold of the living cell at the tips of the finger may die? (02 marks)

c) State the structural and physiological changes that occurred in the body of the thin human throughout the time of experiment.

d) How can thin bodied organisms survive in conditions of low temperature? (03 marks)

**NAMIREMBE HILLSIDE HIGH SCHOOL**



43. Explain what would happen to an individual having malfunctioning liver. (20 marks)

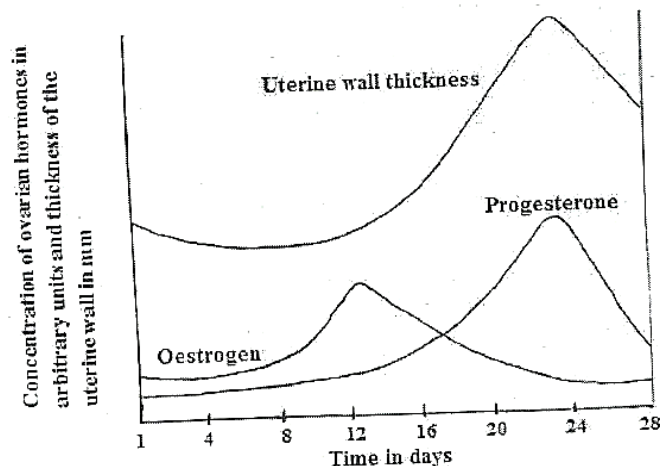
44 (a) Describe how the loop of Henle operates as a counter-current multiplier.

(08 marks)

b) Explain how the different animals have solved their osmotic challenges. (12 marks)

### **Topic 9: Reproduction**

45. The graph below shows the changes in the sex hormones and thickness of the uterine wall obtained by close observations made using blood samples that were withdrawn from an adult human female at regular intervals of days and by scanning the uterus respectively. The investigation was done for over a period of one month (28 days) immediately after the previous menstruation period.



a) Describe the changes in the concentration of;

(i) Oestrogen hormone. (05 marks)

(ii) Progesterone hormone. (04 marks)

b) Compare change in concentration of Oestrogen and thickness of the uterine wall.

(05 marks)

(i) Thickness of uterine wall and progesterone concentration. (12 marks)

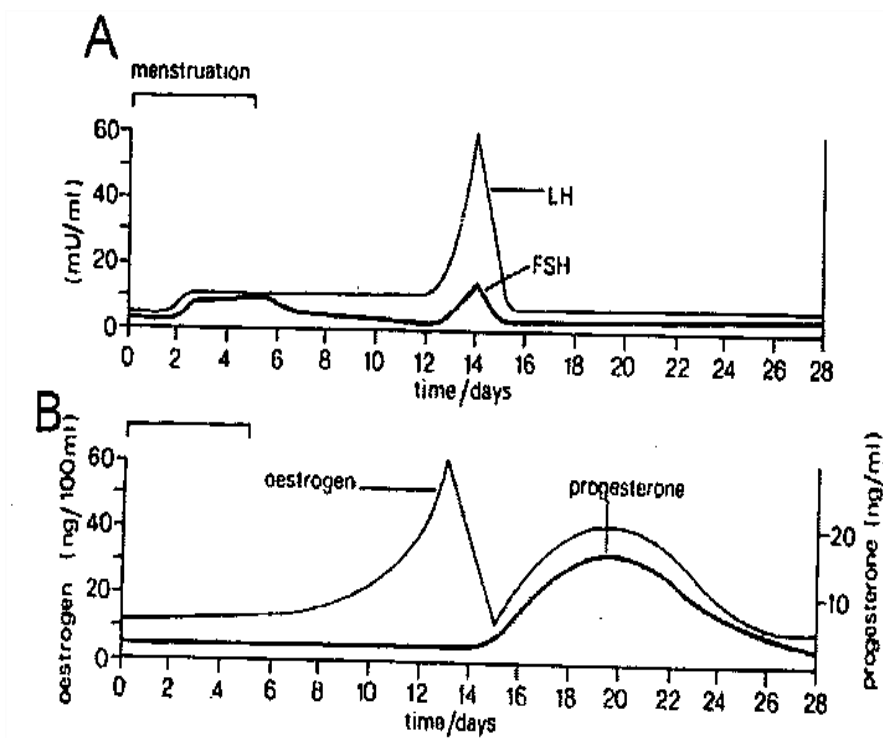
(ii) Oestrogen and progesterone concentration. (10 marks)

c) Explain what would happen if fertilization had occurred on the 21<sup>st</sup> day of the month.

(04 marks)

**MAKINDYE S.S**

46. Graph A and B deal with concentration changes, indicating the amounts of hormones present in the blood throughout the cycle.



- State three general features of animal hormones. (03 marks)
- Using the two graphs in the figure above, explain the changes in the blood levels of the hormones with time during the cycle.
- Basing on the effects of each of the hormones on the secretion of others, show how negative feedback operates in the human menstrual cycle.
- Suggest what would be the effect on the blood level of the hormones if;
  - The ovary of the human is surgically removed
  - Successful fertilization occurred
- Explain how use of each of the following may affect the blood levels of the hormones in the figure above
  - Contraceptive pills
  - Fertility drugs
- State the factors that affect breeding cycles of animals.
- How is courtship of significance in reproduction of organisms?

AMITY S.S, NANSANA GANDA

- 47.(a) Describe how the structure of the placenta is adapted to function. (10 marks)  
b) Describe the foetal circulation changes that immediately after birth. (10 marks)
- 48.(a) Outline the causes of infertility and how they can be treated. (15 marks)  
b) State the preventive measures against infertility. (05 marks)
- 49 (a) Compare the process of development of the pollen grain and the ovule. (08 marks)  
b) Describe the processes leading to the fertilization of an ovule after pollen has landed on the stigma.

### **Topic 10: Coordination**

50. The graph below 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

- a) (i) Giving reasons, identify the types of receptor cells represented by A and B. (02 marks)  
(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 6.3. Give a reason for your answer. (01 marks)
- b) Explain why;  
(i) the greatest concentration of receptor cells type B occurs at position 6.3. (03 marks)  
(ii) On entering a dimly-lit room, objects in the room at first are invisible but gradually become visible.  
(iii) In a dimly-lit room, objects are only visible in black and white colours. (02 marks)
- c) (i) From the graph, identify and describe the features of the receptor cells which allow colour vision.  
(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.

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

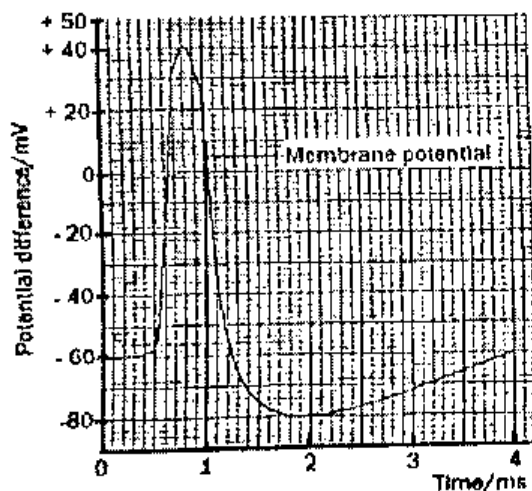


Fig. 1

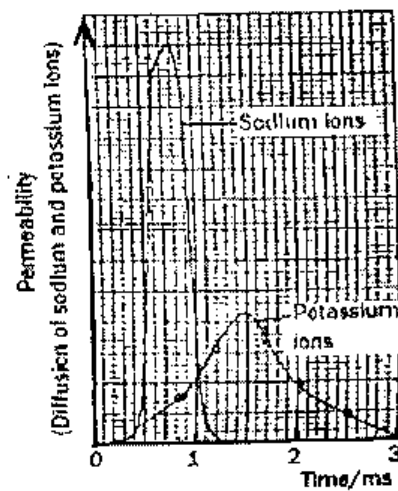
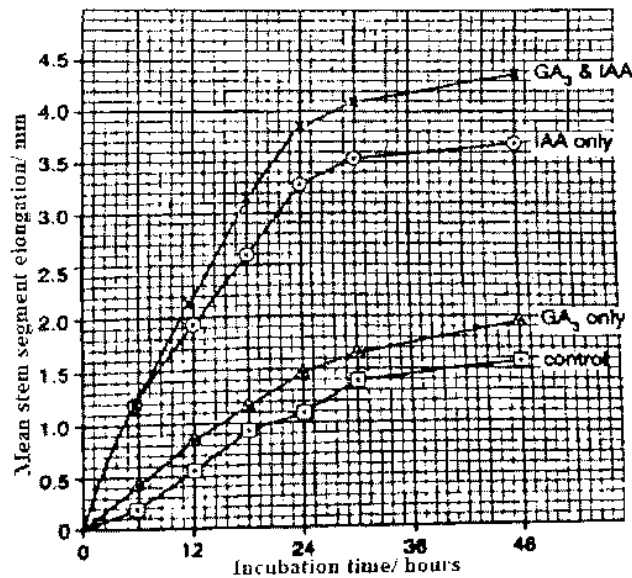


Fig. 2

- a) Compare the trend of diffusion of sodium and potassium ions across the membrane of an axon over a 3 milliseconds (ms) period. (08 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
  - (ii) Sodium ions
  - (iii) Potassium ions
- c) In each case, state two factors which can cause rapid and slow propagation of impulses. (06 marks)
- d) Give the significance of fast conduction of impulses to organisms. (04 marks)

### SKYLINE PROGRESSIVE SS

52. An experiment was carried out to investigate the effect of an auxin indole-acetic acid (IAA) and gibberellic acid ( $GA_3$ ) on the elongation of segments of pea stem. A control group of pea segments received on added IAA or  $GA_3$ . Other groups of pea segments were treated with equivalent quantities of IAA only,  $GA_3$  only or both IAA or  $GA_3$ .



a) Describe the effect of each of the following plant hormones on mean stem segment elongation

(i) Gibberellic acid GA<sub>3</sub>. (03 marks)

(ii) Indoleacetic acid (IAA). (03 marks)

b)(i) With reason, state the biological relationship exhibited by gibberellins and IAA.

(03 marks)

(ii) Explain the difference in the effect on the mean stem segment elongation when the pea plants were treated with IAA only and when treated with a mixture of IAA or GA<sub>3</sub>.

(03 marks)

c) Describe the role of GA<sub>3</sub> in seed germination.

(08 marks)

d) How have farmers used IAA to their benefits?

(04 marks)

53.(a) Distinguish between photoperiodism and a photoperiod.

(02 marks)

b) State the effect of the photoperiod on dormancy of plants.

(04 marks)

c) Describe the role of phytochrome system in the control of flowering in plants.

(14 marks)

54. (a) Compare positive and negative feedback mechanisms of homeostasis. (05 marks)

b) Explain the role of positive feedback in;

(i) Nervous transmission

(ii) Parturition

(10 marks)

c) Explain how the deviation in oestrogen level in blood is reduced to normal. (05 marks)

55.(a) Describe how a nerve impulse crosses a cholinergic synapse. (05 marks)

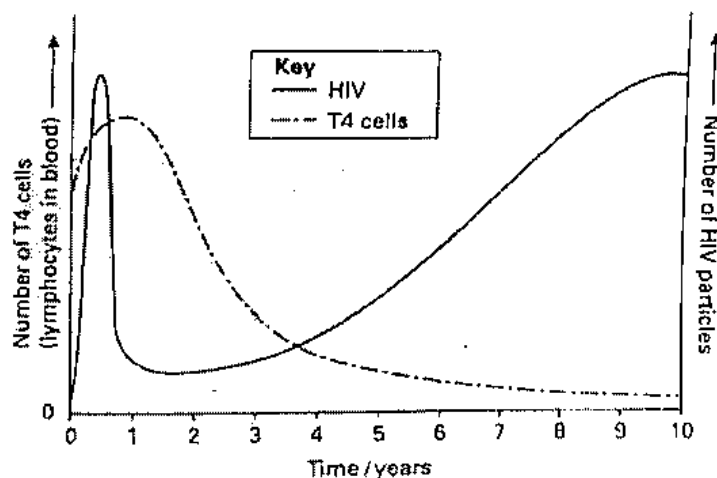
b) Explain the functions of a sensory neurone and a motor neurone in a reflex are.

(15 marks)

### **Topic 11: Immunity & Immune System**

56. The human immune deficiency virus (HIV) is a retrovirus that suppresses the immune system resulting into Acquired Immune Deficiency Syndrome (AIDS). Figure 1 below shows the development of an infection with HIV over a period of 10 years and the changes in the number of T-lymphocytes that active other cells of the immune system. Use this information and figure 1 to answer the question that follows:

Fig.1



a)(i) Describe the variation in number of HIV particles and T-lymphocytes for 10 years.

(05 marks)

(ii) Explain the relationship between the number of HIV particles and T-lymphocytes for the period shown.

(iii) From the figure what evidence shows that HIV suppresses the immune system?

(03marks)

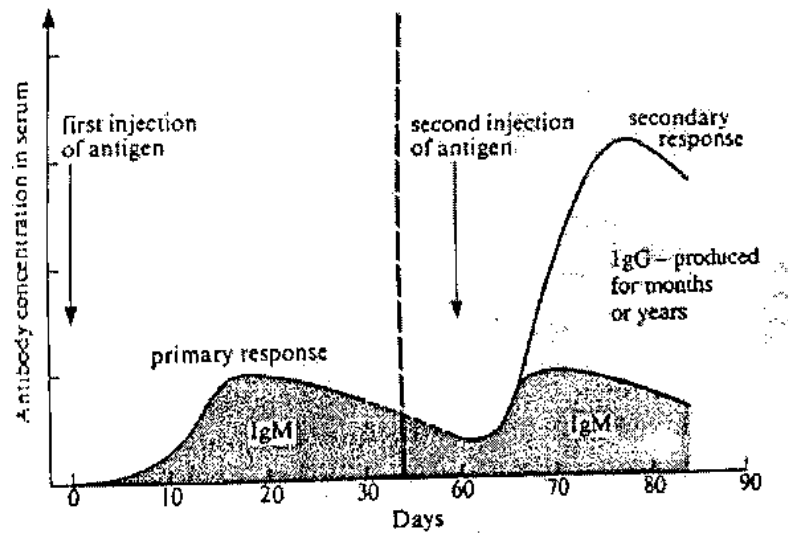
(iv) Predict with a reason what would happen if the development of an infection continued for another five years.

(03 marks)

(v) Suggest a reason why it has taken to obtain vaccine for HIV.

(04 marks)

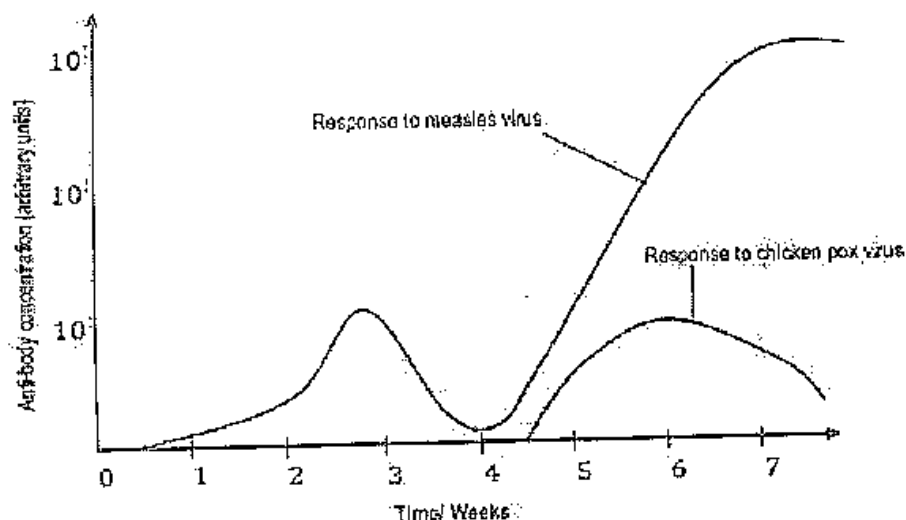
Figure 2 below shows the companion of antibodies produced to the same antigen during primary and secondary response.



- Compare the primary and secondary response. (03 marks)
- Explain how each response is being stimulated. (08 marks)
- From figure 2, what is the significance of a secondary response in the immune system of an individual.
- Suggest other ways in which the body defends its against diseases causing organisms. (02 marks)

### BOMBO S.S

57. The concentration of antibodies of a child was measured over a period of eight weeks. The child was exposed to the measles virus at a time 0 weeks when he inhaled droplets from the infected person. At the fourth week, the child was exposed to the measles virus, and at the same time, he was exposed to chicken pox virus. The results are shown in the graph below.



- a) Compare the variation in concentration of antibodies during the first and second exposure to the measles virus. (06 marks)
- b) Account for the differences in (a) above. (08 marks)
- c) Using the results above, suggest why;
- (i) Children who catch measles for the first time suffer symptoms of the disease, but normally recover completely within two to three weeks of being infected. (05 marks)
  - (ii) A person who has had measles normally is immune for life. (05 marks)
  - (iii) A measles patient is mostly infectious about 8-16 days after first infection. (02 marks)
- d) How do the results above illustrate about the immune response? (01 mark)
- e) State with reasons the type of immunity illustrated. (02 marks)
- f) How have the results of this study been applied by humans in the prevention and control of certain human diseases? (02 marks)
- g) Certain plants called cyanogenic plants use hydrogen cyanide as a defense mechanism against herbivores. The table below shows the average cyanide content of leaves of certain plants of different ages.

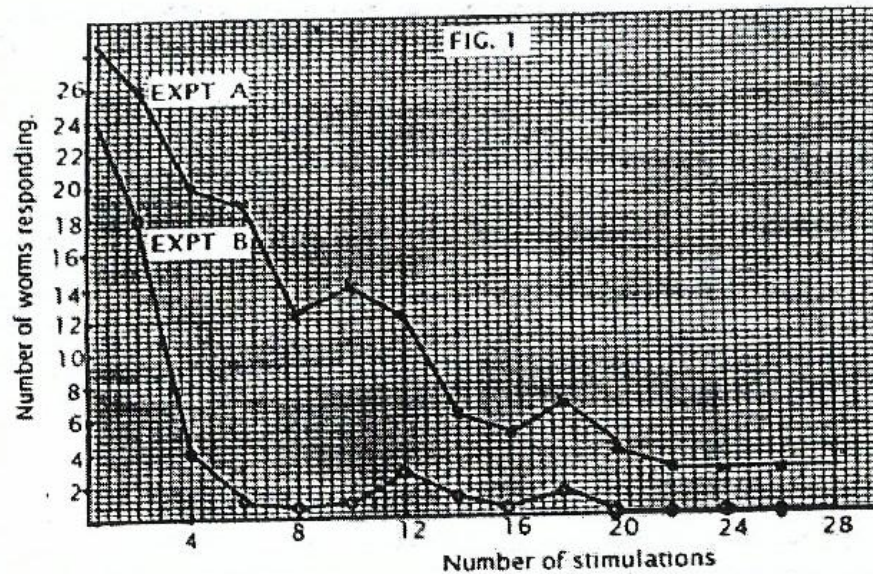


Age of leaf (weeks)	Average cyanide content of leaf (mg/100g by weight)
1	9.9
3	4.3
5	2.1
7	1.0
9	0.5
11	0.2
15	0.0

- (i) Present the information in the table above graphically. (04 marks)
- (ii) State the relationship that exists between cyanide concentration and age of the leaf. (01 mark)
- (iii) In what way could this relationship be of survival value to the plant? (02 marks)
- (iv) Suggest any other defense mechanisms used by plants. (03 marks)

### **Topic 12: Behaviour in Organisms**

58. Figure 1 shows habituation to touch by a group of tube worms *Branchioma*. In this investigation, groups of worms were tested by brushing their protruding branchial crown. Two separate experiments were carried out. In experiment A, the worms were stimulated so gently that they only responded by withdrawing slowly in their tubes. In experiment B, the stimuli were sufficiently strong to excite a rapid response from the worms.



- a) What is the effect of frequency of stimulation on responses of the group of worms in experiment A and B.
  - b) Explain;
    - (i) the differences in the effects of intensity of stimulation on the number of worms responding in both experiment A and B.
    - (ii) the responses of the group of worms in both experiments A and B beyond 22 number of stimulations.
  - c) What advantages does habituation provide to animals.
  - d) Account for the errors made by each of the groups while traversing the maze.
    - (i) Group 1
    - (ii) Group 2
  - e) From the information in figure 2, state any three ways intelligence of an animal can be determined.
59. What is the importance of the following forms of behavior to the survival of the organisms?
- a) Territorial behavior.
  - b) Courtship behavior.

### **Topic 13: Locomotion and Support**

60. (a) Compare the structure and functioning of cardiac and skeletal muscles.
- b) Explain how structural features of birds are related to flight.
61. (a) Discuss the reasons why animals have to move from one place to another.

b) Describe how support is achieved in;

(i) Herbaceous plants.

(ii) Woody plants.

### **Tropic14: Growth and development**

62. (a) Discuss why some seeds are not able to germinate immediately they are dispersed from their parent plants when optimum conditions of germination are provided.

(06 marks)

b) Explain the importance of seed dormancy in plants.

(08 marks)

c) Explain why dormancy is more common in weeds and annual plants than in tropical trees.

(06 marks)

63. (a) What is meant by annual rings?

(02 marks)

b) State the characteristics of secondary xylem and phloem.

(10 marks)

c) Describe the secondary growth changes undergone by phellogen in plants. (07 marks)

**BROAD WAY HIGH SCHOOL**

### **PART 11: PRACTICAL QUESTIONS**

#### **Toad dissection**

##### **Question 1**

You are provided with specimen T which is freshly killed animal.

Place specimen T on a dissecting tray while facing away from you and dissect it carefully to displace the stomach and duodenum to your right hand side and turn the liver lobes anteriorly. Cut the mesentery that holds ileum leaving that of the rectum intact. Displace the ileum to the left of the specimen. Draw and label all internal structures seen in your dissection within the abdominal region.

**(28marks)**

##### **Question 2**

You are provided with specimen K is freshly killed.

Dissect the specimen to display

- i) Blood vessels that carry blood to the left cavity organs with the heart displaced to the right.

- ii) Exposed structures beneath the viscera excluding the liver lobes.

Draw and label your dissection.

**(25marks)**

### **Question 3**

You are provided with specimen K which freshly killed animal.

Dissect the specimen to expose the heart and display

- i) Blood vessels draining right fore limb and head region
- ii) Blood vessels supplying organs for digestion and left hind limb with the heart placed dorsally. Draw and label your dissection

### **Cockroach dissection**

#### **Question 1**

You are provided with a freshly killed cockroach, labeled **specimen Q**.

- a) Suggest the habitat of the specimen with reasons basing on the head. **(05marks)**
- b) lay the animal ventral side uppermost. Observe the structures posterior to the point of attachment to the cercus.
  - i) Count and record the number of abdominal segments visible in this region. **(01 mark)**
  - ii) Draw and label. **(04 marks)**
- c) Lay the animal dorsal side upper most. Cut through the left lateral side of the abdomen and thorax, leaving the anterior most segment of the animal intact. Lift the dorsal cuticle and displace it to one side of the specimen. Cover the dissection with water and clear away the fat bodies and displace the alimentary canal to the right of the specimen to display structures for food storage and digestion. Draw and label the exposed structures on both cuticles anterior to the sixth abdominal segment. **(18 marks)**

#### **Question 2**

- a) Using a low power microscope, examine the ventral view of the pretarsus.
  - (i) Describe the structure of the pretarsus **(3 marks)**
  - (ii) Draw and label the observed structures of the pretarsus including the three segments anterior to the pretarsus. **(4 marks)**
- (b) Place the animal ventral side upper most. Draw and label the ventro-posterior end of the abdomen together with its associated structures. **(3 marks)**
- (c) Place the specimen dorsal side upper most, cut through the left hand edge of the exoskeleton of the abdomen and dissect to expose the structures with in the abdominal

region. Displace the alimentary canal to the left of the animal. Remove the unnecessary tissue to display all the parts of the alimentary canal responsible for digestion, removal of unwanted materials and structures on the dorsal cuticle anterior to **the 7<sup>th</sup> abdominal cuticle**. Draw and label your dissection. **(18 marks)**

### Question 3

a) You are provided with **specimen Y**. Examine it carefully and answer the questions that follow. Display the animal on the dissecting board with the dorsal side upper most. Cut along one lateral line of the specimen, except its three anterior most segments and displace the dorsal terga to the left and alimentary canal to the right. Draw and label the structures exposed on the ventral and dorsal tergum that are used for removal of insoluble nitrogenous waste, reproduction, sensitivity, breakdown and absorption and transport of the digested nutrients and oxygen. **(22 marks)**

### Rat dissection

#### Question 1

**(40 marks, 60 minutes)**

You are provided with a freshly killed specimen labeled R

- i) With reference to the cover the body, give the importance of each of the structure to the animal. **(03marks)**
- ii) Examine feet of the animal, how are they adapted for its survival in the habitat **(03marks)**

b) Dissect the specimen on the tray to expose the superficial structures of the ventral side of the neck, displace the visible neck structures and their accessory structure anteriorly. Draw and label the

musculature of the neck, chest region and thoracic region. **(12 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. **(24marks)**

#### Question 2

a) i) Observe the head of specimen M from the dorsal view. Draw and label the visible structures used for sensitivity. **(06marks)**

b) ii) Dissect the specimen to expose the musculature of the neck, thorax and fore limbs up to the elbows.

Draw and label. **(10marks)**

c) Pin the specimen provided ventral side up and make a median longitudinal cut through the skin and pin back the skin. Carefully open up the thoracic cavity by cutting through the ribs on either side to the neck.

Display the heart and associated blood vessels.

Turn over the heart upside down and pin it to your left-hand side.

**Display the following:**

Blood vessels that carry blood to the left side of the head region, fore limbs and visible structures in the thoracic cage in undisplaced state. Draw and label your dissection to show the parts you have displayed. **(24 marks)**

c) By further dissection, display the route of blood flow from the hind limb, abdominal back muscles,

and the kidney on the left. Draw and label **(13 marks)**

**Question 3**

You are provided with specimen T which is fleshly killed.

a) Examine the hind limb and state three ways it is adapted for the survival of the specimen in its habitat. **(03 marks)**

b) Examine the head of the specimen and draw and label the ventral view of the anterior part of the head to show the structures for sensitivity. **(05 marks)**

c) Dissect the abdominal region of the specimen to expose the blood vessels.

i) Returning blood from the structures for reproduction and secretion.

ii) Supplying the structures for absorption of nutrients and excretory organs.

Draw and label **(27 marks)**

END

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**SSEKANDI ISA**

**0701467746,0787119579**

**Company CEO**

