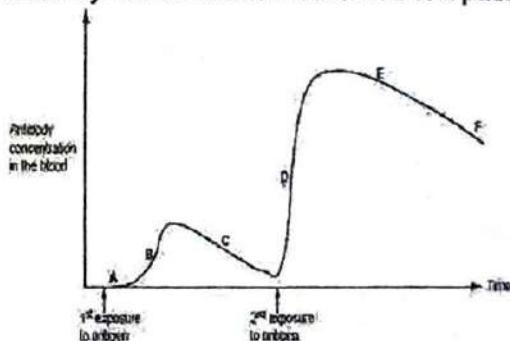


## UMSS NAMUGONGO 'A' LEVEL INTERACTIVE SEMINAR QUESTIONS SLATED 20<sup>TH</sup>/OCTOBER, 2024

1. Antigens on the surface of pathogens can provoke an immune response in a patient. The figure shows the changes in antibody concentration in the blood of a patient after exposure to the same antigen at different times.



- a) What observations can be made from the graph?
- b) Give an explain for the shape of the curve as indicated by the letters.
- c) (i) On the same curve, sketch a different curve at time of second exposure to antigen; if a different antigen was administered at that time.  
 (ii) Suggest explanation for curve sketched in (c) (i) above.  
 (iii) Explain why jab of a given vaccine is administered several times to an individual.  
 (d) Explain why many varieties of pathogenic bacteria are now resistant to a range of antibiotics.

(e) How is immunity naturally achieved by the human respiratory system?

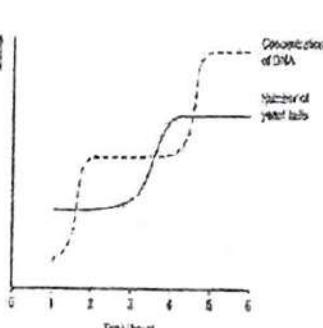
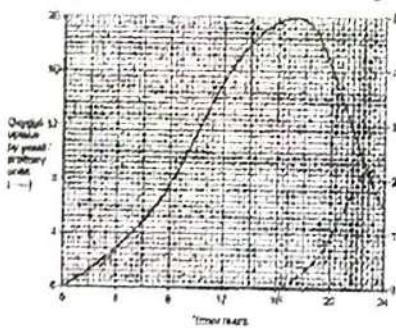
f) Explain the basis for; (i) Blood group determination (ii) Blood transfusion **UMSS NAMUGONGO**

2. a) During transpiration, water diffuses from cells to the air surrounding a leaf. The rate of transpiration of a plant growing in a pot under different environmental conditions was measured. Their results are shown in the table.

Conditions	Transpiration rate/ $\text{gh}^{-1}$
A still air	15°C
B moving air	15°C
C still air	25°C

- i) Briefly describe how the rate of transpiration can be estimate
- ii) Suggest an explanation for the difference in the rate of transpiration in the different conditions.
- b) Scientists investigated the rate of water movement through the xylem of a twig from a tree over 24 hours. The graph shows their results. It also shows the light intensity for the same period of time.
- i). Describe the relationship between the rate of water movement through the xylem and the light intensity
- ii). Explain the change in the rate of water movement through the xylem between 06.00 and 12.00 hours.
- iii) The scientists also measured the diameter of the trunk of the tree on which the twig had been growing. The diameter was less at 12.00 than it was at 03.00 hours. Explain why the diameter was less at 12.00 hours
- c). Discuss the role of each of the following in plants;
- i). Hydathodes ii). Casparyan strip
- d) Arteries and arterioles take blood away from the heart. Explain how the structures of the walls of arteries and arterioles are related to their functions. **NDEJJE SS**

3. Yeast is one of the most important unicellular organisms belonging to kingdom fungi. A group of scientists carried out an experiment to investigate respiration in the population of yeast growing in a sealed container and the results of their investigation are presented in the graph below.

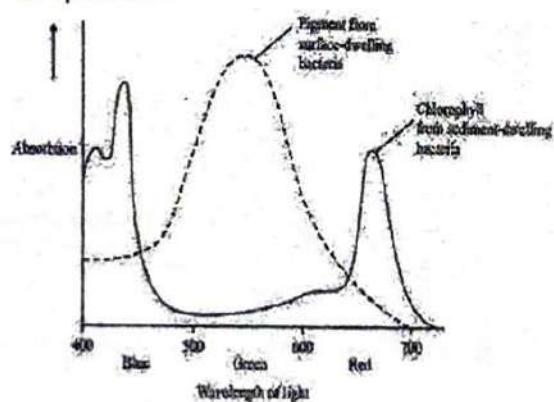


- a) Calculate the rate of oxygen uptake between 2 and 4 hours
- b) Account for the changes in oxygen uptake during this investigation
- c) Explain the changes in production of ethanol during this investigation
- d) Yeast is a single-celled eukaryotic organism. When yeast cells are grown, each cell forms a bud. This bud grows into a new cell.

This allows yeast to multiply because the parent cell is still alive and the new cell has been formed. Scientists grew yeast cells in a culture. They counted the number of cells present and measured the total concentration of DNA in the culture over a period of 6 hours. Their results are shown in the graph above. Explain the shape of the curve for the number of yeast cells; i) between 1 and 2 hours ii) between 3 and 4 hours.

e) Use the curve for the concentration of DNA to find the length of a cell cycle in these yeast cells. Explain how you arrived at your answer. **TRUST HIGH SCHOOL KABUBBU**

4. There is evidence that the first photosynthetic organisms were primitive water-dwelling bacteria. The very first of these lived near the surface of the water in lakes and contained a purple pigment that absorbed light most strongly in the green region of the spectrum.



Later, other bacteria evolved that lived on the top of sediment at the bottom of the lakes. Gene mutations had enabled these bacteria to synthesize chlorophyll instead of the purple pigment present in the bacteria living near to the surface. Chlorophyll absorbs light most strongly in the blue and red regions of the spectrum.

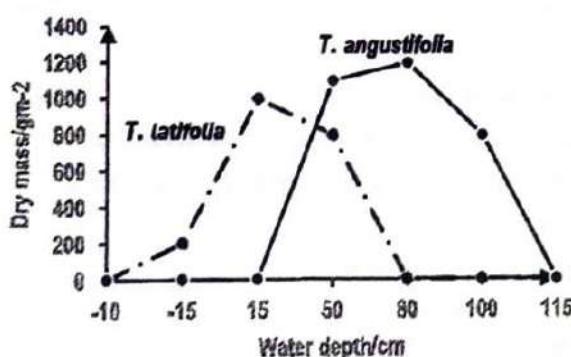
(a) Describe how light energy absorbed by chlorophyll molecules is used to synthesise ATP

(b) Use the figure to explain how natural selection would favour the evolution of sediment-dwelling bacteria containing a different photosynthetic pigment from those living near the surface of the water

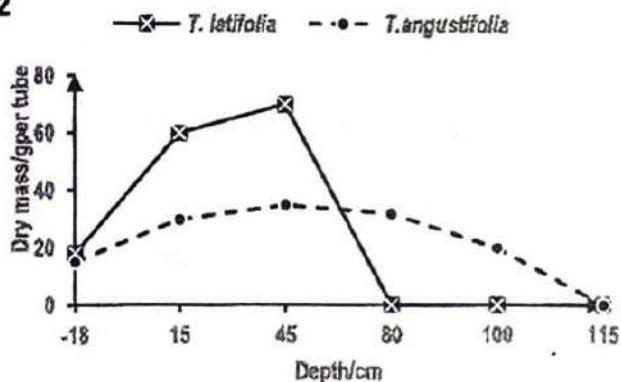
(c) Explain the evidence that shows that photosynthesis is a double stage reaction. **KINAAWA HIGH SCHOOL**

5. *Typha latifolia* and *Typha angustifolia* are plants that grow on the margins of ponds and lakes. Figure 1 shows the natural distribution of *T. latifolia* and *T. angustifolia* in the lakes. a) Compare the distributions of the two species within the lake. (b) Figure 2 shows the results of an experiment in which species were planted separately in tubs, and placed at different depths in water to assess their growth. Explain the variation of the dry mass with the depth of the two species.

**Figure 1**



**Figure 2**



c) Explain the differences between the fundamental and realized niches of *T. angustifolia*.

d) Explain any two sampling techniques that can be used to investigate the distribution of plants at increasing depths of water from the shore of a lake. **MERRYLAND SS**

6. a) Distinguish between fast twitch and slow twitch muscles.

b) Describe how arrival of an action potential at the synaptic terminal of a motor neuron brings about muscular movements in animals.

c) Discuss how various forms of instabilities are overcome by fish during swimming.

d) There is an increase in the activity of the enzyme ATPase during muscle contraction. An investigation into muscle contraction involved measuring the activity of ATPase in solutions containing ATP, myosin and different muscle components. The table shows the results

solution	Contents	ATPase activity/arbitrary units
A	ATP, myosin and actin	1.97
B	ATP, myosin, actin and tropomyosin	0.54
C	ATP, myosin, actin, tropomyosin and calcium ions	3.85

i) Explain the importance of ATPase during muscle contraction.

ii) Explain the difference in the results between; A and B; B and C. **MIDLAND KAWEMPE**

7. Methanol is a substance that is used as a fuel in cars and trucks. If accidentally swallowed, it enters into body cells and gets converted into poisonous formaldehyde and formic acid catalysed by dehydrogenase enzyme. The same enzyme can catalyse breakdown of ethanol to ethanal in living cells. In an investigation carried out on body cells of a person who had accidentally swallowed methanol, the rate of formation of formaldehyde and ethanal was measured when the cells were treated with varying concentrations of ethanol. A graph was then plotted as shown in figure 1 below.

Figure 1

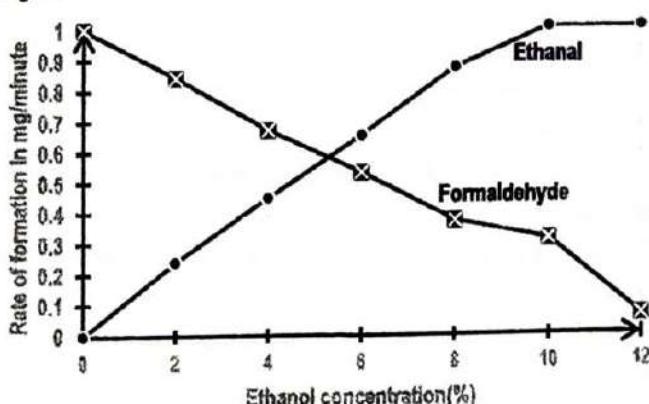
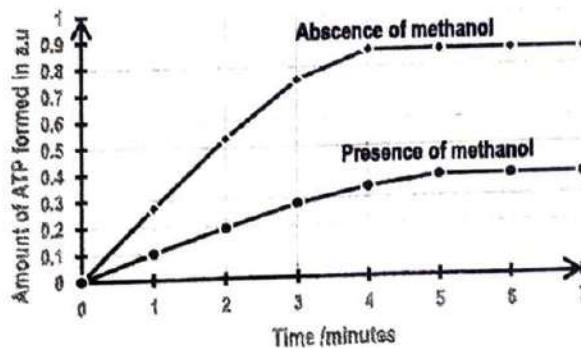


Figure 2



a) Compare the rates of formation of formaldehyde and ethanal.

b) Suggest an explanation for the observed effect of ethanol concentration on rate of formation of ethanal.

c) In another investigation, the amount of Adenosine Triphosphate (ATP) formed in a person's cells was measured in both presence and absence of methanol. A graph was then plotted as shown in figure 2 above.

i) Account for the physiological significance of the difference in observed changes in amounts of ATP recorded in presence and absence of methanol.

ii) From the investigations made, state how a person can be saved from methanol poisoning. Give a reason for your answer.

d) Describe how ATP can be produced from ethanol in living cells. e) Discuss the various categories of enzymes.

f) With examples, describe the roles of different types of co-factors in metabolic pathways. **KIBULI MUSLIM SS**

8. Roughly 60% of the mass of the body is water and despite wide variation in the quantity of water taken in each day, body water content remains incredibly stable. One hormone responsible for this homeostatic control is vasopressin.

a) (i) What is meant by the term diuresis. (ii) Describe the mechanisms that are triggered in the mammalian body when water intake is reduced.

b) The graph below shows how the plasma concentration of vasopressin hormone changes as plasma solute concentration rises

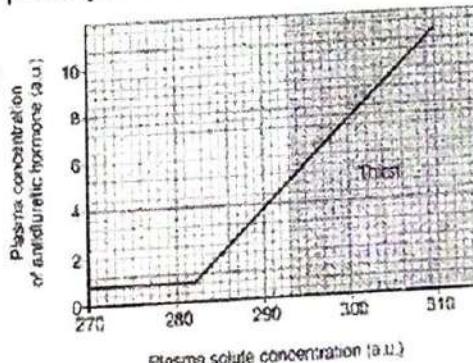
(i) Describe the relationship shown in the graph. (ii) Suggest why a person only begins to feel thirsty at a plasma solute concentration of 293 a.u

c) Secretion of vasopressin hormone is stimulated by decreases in blood pressure and volume. These are conditions sensed by stretch receptors in the heart and large arteries. Severe diarrhoea is one condition which stimulates vasopressin secretion. Suggest another condition which might stimulate vasopressin secretion.

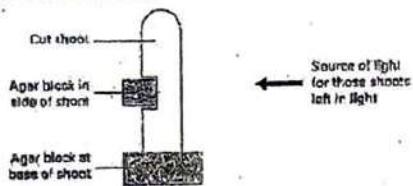
d) Explain the evolutionary significance of secretion of vasopressin hormone in living organisms. **KYABAZINGA COLLEGE KAMULI**

9. a) Explain the role of calcium ions in the following biological processes in living organisms.

(i) Stomatal closure (ii) Fertilization in humans (iii) Gravitropic response in root apex (iv) Synaptic nerve transmission



b) The diagram shows how movement of auxin through plant shoots was investigated. Shoots were removed from plants and each was placed on a block of agar. A second block of agar was placed in the side of each shoot where half of its tissue had been cut away. Samples of shoots treated in this way were left for several hours. Half the shoots were left in darkness and half were left with a light source from one side. The concentration of auxin collected in the two blocks of agar from each shoot was measured. The table below shows the mean percentage of auxin found in the two blocks of agar from each shoot.



Location of block	Mean percentage of auxin collected in the two agar blocks from each shoot.	
	Shoot in dark.	Shoot lit from side
Side of shoot	27	35
Base of shoot	73	65
Both blocks	100	100

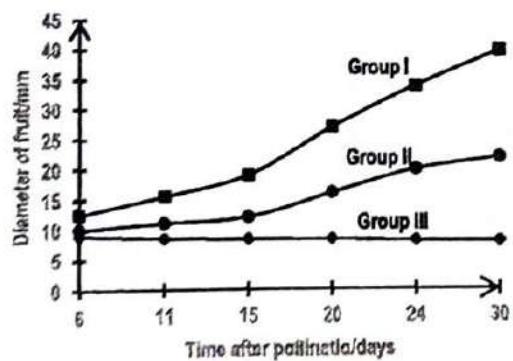
- i) What do the results of this investigation show about the movement of auxins?  
ii) Explain how the movement of auxins shown in this experiment enables intact plants to photosynthesize efficiently.

### MITYANA SS

10. a) what is meant by the term lactational anovulation?  
b) Explain the significance of the following changes observed in the different classes in kingdom animalia.  
i) The avian embryonic hindgut rapidly expands forming an outgrowth which underlies the chorion within the cleidoic egg.  
ii) Milk production in lactating mother increases with frequent suckling of the young  
iii) Lysosomal activity of trophoblasts increases prior to implantation of the blastocyst.  
c) Compare embryo development in birds and mammals.  
d) Explain the different mechanisms used by mammals to increase their chances of fertilization. RISE AND SHINE

### HIGH SCHOOL

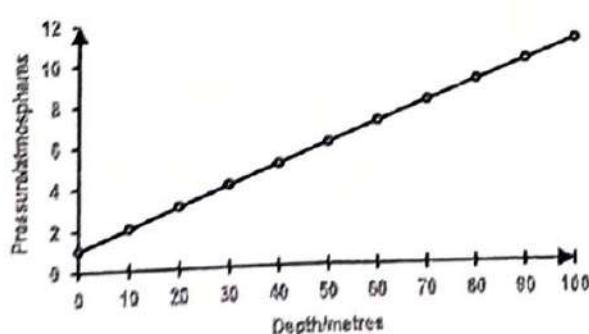
11. The figure below shows the effect of plant growth substances (auxins) on the size of fruits. Three groups were considered in the experiment and treated as follows. Group I, achenes removed after pollination and not treated with auxins. Group II, achenes removed after pollination and treated with auxins. Group III, achenes not removed after pollination and not treated with auxins.



- a) Compare the changes in diameter of the fruit for the following groups  
i) II and III ii) I and III  
b) Explain the difference in the variations in the diameter of the fruit for groups. (i) II and III (ii) I and III  
c) Explain how a synthetic broad-leaved herbicide can be used to improve productivity in cereal crops.  
d) Explain how agriculturalists prevent preharvest fruit drop and state the advantage of the tendency of early fruit drop to a fruit tree.  
e) Explain how dandelion is naturally adapted for parthenocarpic fruit development. ST. HENRY'S COLLEGE KITOVU

12. a). Distinguish between counter current and concurrent mechanisms in gaseous exchange.

- b) Describe the role played by peripheral chemoreceptors in controlling ventilation in man.

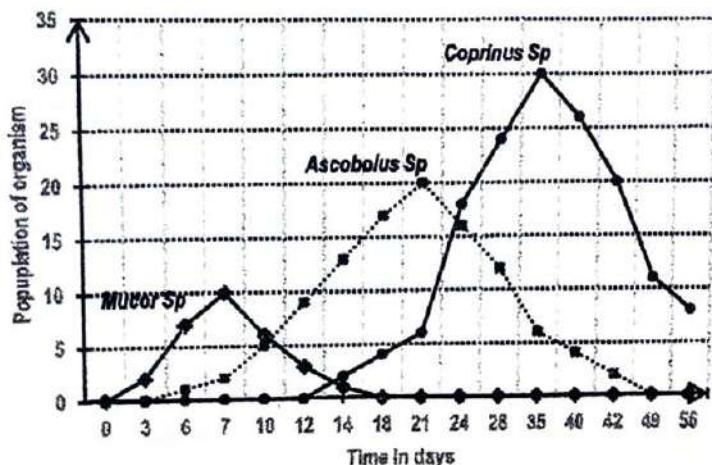


- c) The figure below shows the variation in pressure with increasing depth in the lake. Use it to answer the questions that follow. i) Describe the relationship between pressure and depth. ii) Explain the effect of the relationship described in (i) above on divers using a breathing apparatus with constant partial pressures of oxygen.  
d) Account for the significance of the following; i) Divers are advised to ascend slowly to the water surface from deep water bodies rather than rapid swimming. (ii) Inhalation being a more active process than exhalation in humans.

Despite having low metabolic rate, fish have a higher ventilation rate than terrestrial organism of the same surface area to volume ratio. (e) Discuss the adaptations of diving mammals. **NAMILYANGO COLLEGE**

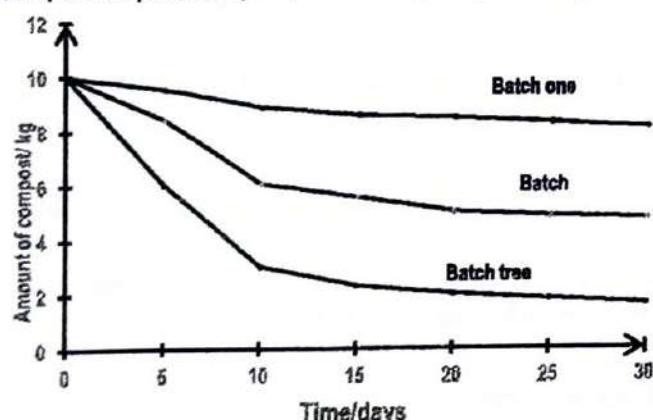
13. The figure below shows the findings of an investigation carried out to determine the variation in the population density of three different forms coprophilous fungi flourishing on herbivorous dung in their successional trend. Table 1 shows the nutritional requirements of the fungi species used in the investigation.

Fungi species	Nutritional requirements
Mucor Sp.(phycomycetes)	Feed on sugars, amino acids, fatty acids, glycerol, starch, proteins and fats
Ascobolus Sp.(ascomycetes)	Feed on cellulose, and hemicellulose
Coprinus Sp.(basidiomycetes)	Feed on lignified structures (fibres and xylem vessels) in the dung



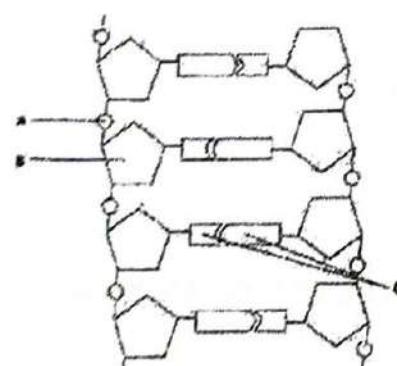
- Describe the variation in population of the following fungal species. (i) *Mucor Sp.* (ii) *Coprinus Sp.* (iii) *Ascobolus Sp.*
  - Account for the variations in the population density for each of the fungal species in (a) above.
  - Briefly explain the nutritional and environmental factors that determine the success of saprotrophic fungi with a named example.
  - Discuss the ecological importance of saprotrophic fungi.
- ENTEBBE SS**

14. The graph below shows the results of an experiment carried out to investigate the rate of decomposition of garden waste in three different settings. Three different categories of compost were used in the experiment and treated as follows. Batch one; unheaped compost, batch two; heaped compost, batch tree; finely chopped heaped compost.



- Compare the rate of decomposition of garden waste for batches:
- (i) One and three (ii) Two and three
- (i) Explain the differences in the rate of decomposition observed in batch two and three
- (ii) Explain the effect of burying garden waste on the rate of decomposition.
- Explain the significance of hydra exhibiting both extracellular and intracellular digestion. **BUWEMBO SEED SS**

15. DNA is the hereditary material that has instructions that direct protein synthesis. During the cell cycle the molecule replicates and during this time, mistakes are bound to happen however, they don't happen and if they do happen, they're very few. The figure below shows a part of DNA molecule. Study it and answer the questions that follow.

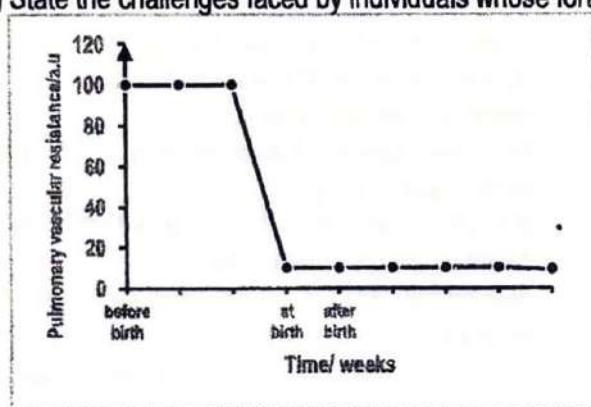


- Name the structures represented by letters A, B and C and state the structural characteristics of DNA based on the image
- State how structure B would differ in an HIV virus genome
- Why does the molecule replicate prior to cell division?
- State how mistakes (mutations) are minimized during replication
- In an experiment to investigate the type of mutation caused by a certain mutagen X, it was found out that treating X with a certain DNA piece reduced its length. If the DNA remnant has 40 base pairs of which, TAC and ATT were among the codons present,

- i) determine the maximum numbers of Amino-Acids you would expect to find in a protein formed from such DNA.  
 ii) Assuming the normal polypeptide chain is composed of 40 different Amino-Acids, explain how this mutation may affect the functionality of the formed protein. Make an assumption that the normal protein forms Ach receptor. Explain why this type of mutation might be more dangerous than that involving single base substitution. **LUGAZI HOMESTONE SCHOOL**
15. a) Distinguish between environmental stress and physiological drought.  
 b) Explain how plants overcome the following forms of environmental stress  
 i) biotic stress (ii) abiotic stress

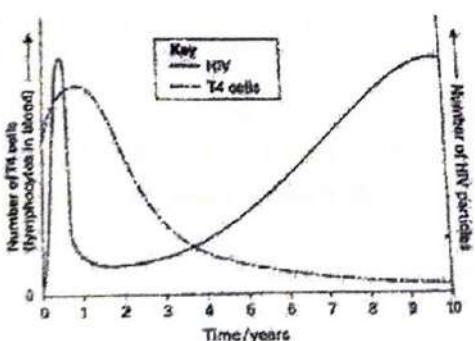
c. Identify the different forms of positive/positive (+/+) relationships exhibited by plants and explain their significance to the plants. **KABOWA HIGH SCHOOL**

16. The figure below shows changes in pulmonary vascular Resistance (PVR) in the lungs of a human being before and after birth.  
 a) Describe the changes in PVR with time  
 b) Explain the difference in PVR between the fetus and the baby  
 c) Explain why blood does not flow from the left side of the heart to the right side of the heart after birth yet it does flow from the latter to the former in fetal stage.  
 d) State the challenges faced by individuals whose foramen Ovale (FO) fails to close after birth.



- e) Other than the closure of the FO in the baby weeks after birth, state other changes you expect to have occurred during the same time frame.  
 f) State the significance of most of the blood bypassing the lungs and liver through ductus Arteriosus and Ductus venosus respectively.  
 f) Why should some blood flow to the lungs yet there is no oxygen nor carbon dioxide to be exchanged in a fetus? **MT. ST. MARY'S COLLEGE NAMAGUNGA**

17. CD4 (T4) are cells of the adaptive immune system that collaboratively work with other lymphocytes to fight against infections. They work by producing chemical messengers called cytokines and membrane bound protein which stimulate B cells to produce antigen specific antibodies which engage the innate immune system.



The figure below shows how the number of T4(CD4) and HIV particles change in an HIV patient within a period of 10 years.

- a) Explain the relationship between T4 and the number of HIV particles  
 b) State how the T4 recognize the HIV Virus in this patient  
 c) From the graph,  
 i) state the challenge (s) HIV patients face after the 7<sup>th</sup> year of infection  
 ii) with the reason, state the time frame when the patient is least and most infectious.

**SEETA HIGH SCHOOL MBALALA CAMPUS**

18. In a certain mammal, X a cross between a male individual having normal eyes, small ears with a female individual having big ears and buggy eyes produced all offspring having big ears and buggy eyes. In another experiment, an F1 individual was crossed with an individual having small ears and normal eyes and the results from the experiment are shown in the table below.

Percentages	Genotype	Phenotype
48%		Big ears, buggy eyes
2%		Big ears, normal eyes
2%		Small ears, buggy eyes
48%		Small ears, normal eyes

- a) Based on the results in the table, calculate the phenotypic ratio of the offspring  
 b) With the help of genetic symbols, explain how such a phenotypic ratio arises.  
 c) Determine the genotypes of all the offspring in the table  
 d) Determine the distance between the genes for ear size and shape of the eye. **PASSION CHRISTIAN HIGH SCHOOL**
- 19.a) what is meant by the term an escape response in animal behaviour

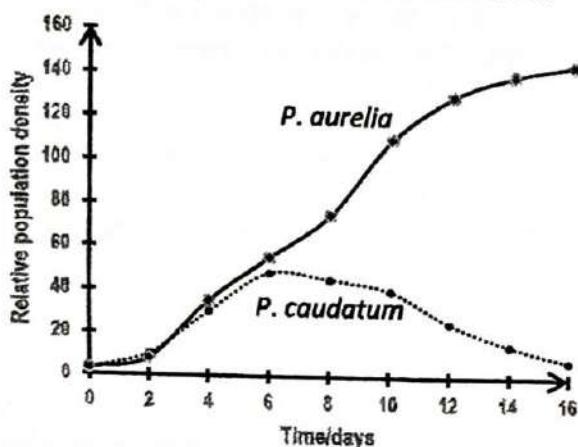
- b) Distinguish between the following terms as used in animal behaviour

- (i) Motivation and motivating stimulus (ii) imprinting and imitation (iii) pheromones and hormones  
 c) with examples, explain the role of exogenous rhythms in animals  
 d) Account for the following observations made in animal behaviour. (i) learning new skills ceases in decorticate dogs and continue performing motor activities efficiently. (ii) Woodlice nocturnal activity diminishes with interruption of flashes of torch light. (iii) Amount of mRNA content increases in the cells of an organism during learning of new skills. **KAJJANSI**  
**PROGRESSIVE SS**

20. a) What is meant by term associative learning b) Compare the different forms of associative learning c) Explain the role of hypothalamus in animal motivation

d) Discuss the role played by pheromones in the following aspects of animal behaviour. (i) Reproductive behaviour (ii) feeding behaviour (iii) defensive behaviour (iv) maintenance of social organization. e) Explain how the following are minimized among organisms. (i) Mate cannibalism (ii) Fighting **VISION FOR AFRICA HIGH SCHOOL**

21. a) State the competitive exclusion principle. b) The figure below shows the results of an experiment conducted using two different species of paramecia in the same culture.



- (i) state the interaction between the organisms with reasons.  
 (ii) account for the difference in their maximum population density attained in the experiment.  
 (iii) explain the evolutionary significance of the relationship shown in the figure above.  
 c) briefly explain the conditions under which the competitive exclusion principle is modified.  
 d) (i) explain how the application of broad-spectrum pesticide results in pest resurgence.  
 e) The table below shows the number of deaths of predatory birds during different stages of their life cycle in an area that was sprayed with a broad-spectrum pesticide for an experiment conducted in wet season.

Life cycle stage	Number of deaths/months.
Juvenile	20
Reproductive (egg laying and incubation)	60

- i) Explain the difference in the death rate during the different stages in the predatory bird life cycle  
 ii) Another experiment was carried out during drought to establish the death rate of predatory birds in the same environment. State and explain how the death rate for both juvenile and reproductive stages would vary. **IGANGA GIRLS SS**

22. A study was conducted on germinating maize seeds to determine the rate of ethanoic production by intact seeds and seeds whose testa were removed (non-intact seeds). The results are shown on figure 1 below. In another experiment using maize seeds in a green house, the changes in mass of starch and amylase concentration during germination was determined at a two – day interval. The results are shown on figure 2 below

Figure 1

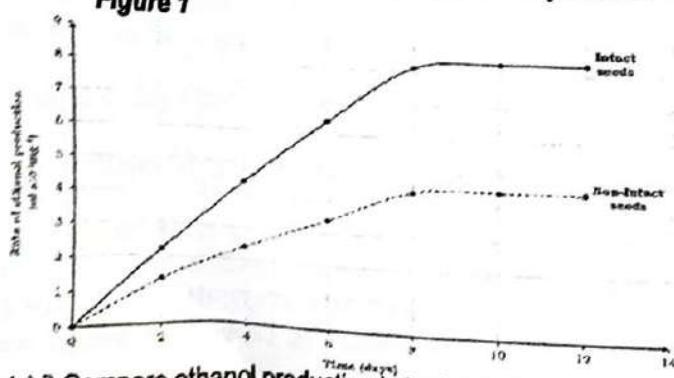
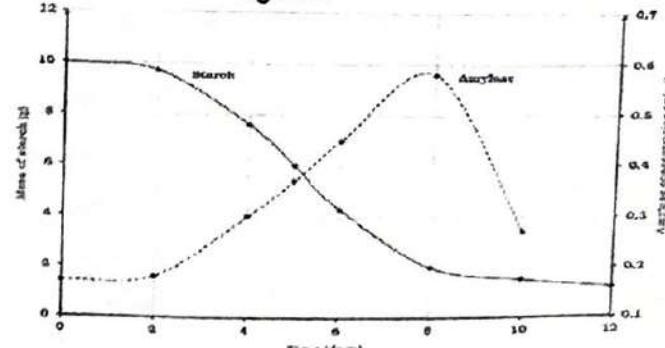


Figure 2



- (a) i) Compare ethanol production in both intact and non – intact seeds. (ii) Explain the difference in the rate of ethanol production in figure 1 above.

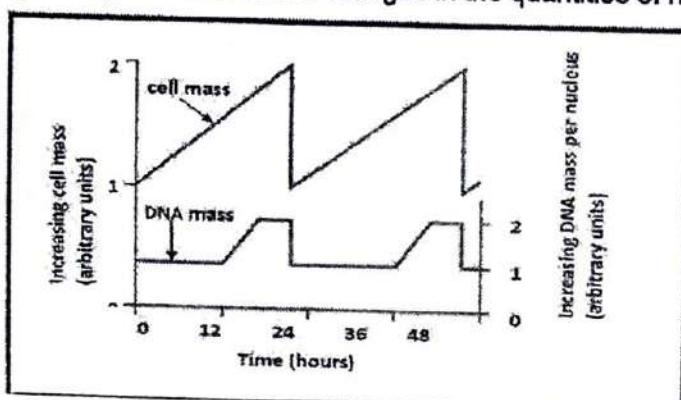
(b) (i) Describe the variation in the amount of starch in the maize seedling. (ii) Explain the relationship between starch and concentration of amylase during; (1). the first 2 days (2). after 2 days. (c) Suggest and explain how the quotient of the two types of seeds in figure 1 would be compared.

Explain why; (i) experiment 2 was conducted in a green house. (ii) many plants cannot tolerate prolonged synthesis of ethanol. (d) From figures 1 and 2, what conclusion can you make about the physiology of germination in maize.

(ii) Name two internal factors that could affect the results of the second experiment. **SAVIOR HIGH SCHOOL KIBOGA**

24. In summer squash the fruits are either green or yellow. Yellow being dominant to green. Another gene responsible for colour deposition is recessive state otherwise when this gene is in dominant state, there is no deposition of colour in the fruit and the fruit is white. a) Explain the form of gene interaction above. b) Using genetic symbols, write the possible genotypes of yellow, green and white fruits. c) Work out the F<sub>2</sub> phenotypic ratios, if offsprings of a cross between double dominant variety of white fruits and green fruits were selfed.

d) The figure below shows changes in the quantities of nuclear DNA and cell mass during repeated cell cycle.



From the graph, deduce the number of cell cycles the cell has undergone with reasons.

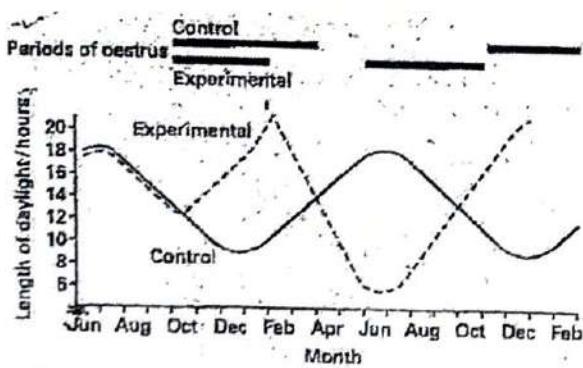
i) Compare the changes in the masses of DNA and the cell during 1 cycle.

ii) Explain the differences in the masses of DNA and the cell during 1 cycle.

iii) Explain the factors that cause the cell to divide.

**MT. ST. HENRYS COLLEGE MUKONO**

25. The graph below shows the effect of light on the period of oestrus in two groups of Suffolk ewes (female sheep). Ewes in the control group were subjected to the normal seasonal variation in day length. Part way through the first year of the experiment, ewes in the experimental group were subjected to a reversed day-length cycle. The period of oestrus of each group of ewes is shown as solid bands above the graph.



a) (i) During what time of the year did the oestrus normally occur?

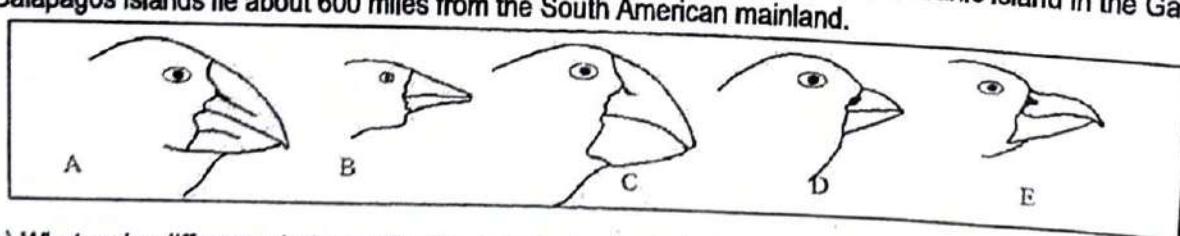
(ii) Suggest one advantage of this pattern of oestrus to the ewes in the control group.

(b) What does the experiment suggest about the regulation of the onset of oestrus in ewes?

(c) State what would happen if the barrier between fetal capillary and the wall of the villus was obliterated and replaced with a simple squamous tissue.

(d) Name the harmful substances and the properties they possess that enable them to cross the placenta. (e) State other functions of the placenta to the fetus

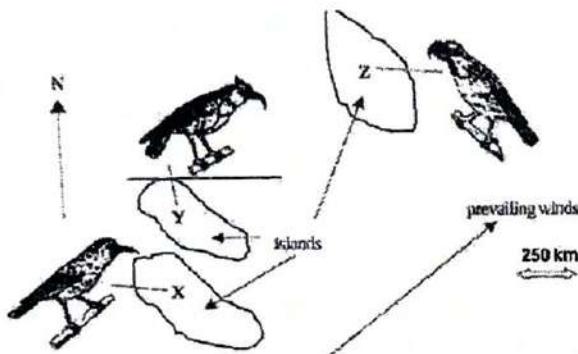
(f) Explain the difference between the embryonic development in humans and amphibians **TURKISH LIGHT ACADEMY**  
26. Figure below show the heads of five species of finch inhabiting a volcanic oceanic island in the Galapagos group. The Galapagos islands lie about 600 miles from the South American mainland.



a) What major difference between the five species is shown in the figure and how might this difference be related to the habits of the finches?

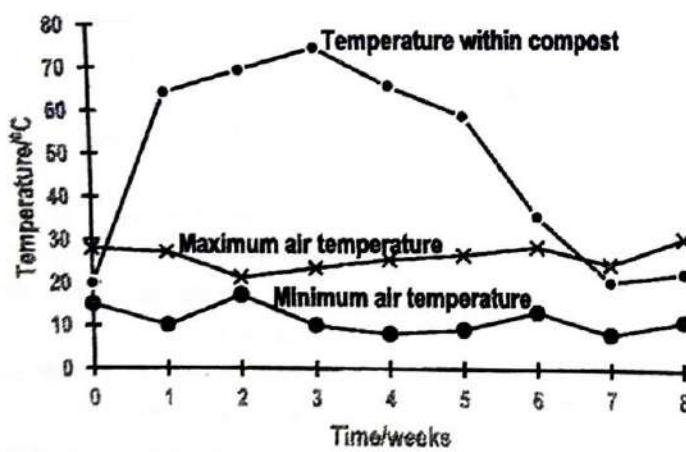
Darwin suggested that these finches probably descended from a common ancestral stock of finches. Explain how these ancestral finches may have reached the Galapagos islands.

- Explain how the modern diversity of finches arose from the ancestral stock.
- The different finch species on the island do not interbreed. Explain this observation.
- The plumage of the different finch species present is very similar. Suggest ways in which males and females of the same finch species may recognize each other.
- Three distinct populations of birds, X, Y and Z live on three isolated oceanic islands. The birds are all omnivorous, eating insects, tiny seeds and nectar, but have slightly different beaks and feather colourings. The islands are frequently swept by strong south-westerly gales. Populations X and Y can interbreed and form fertile offspring. Population Y can interbreed with population Z but the offspring are sterile. Population X will not even mate with population Z and artificial insemination of Z birds with X bird sperm is unsuccessful.



- Suggest an explanation why populations X and Y can still interbreed and form fertile offspring.
- Suggest an explanation why mating between Y and Z produces infertile offspring.
- Suggest an explanation for the inability of populations X and Z to mate. **OUR LADY OF AFRICA MUKONO**

27. Compost heaps have for long been used by farmers in recycling of nutrients. The figure below shows the variation of temperature within a compost heap, and air temperatures over an 8-weeks' time frame. Study it and answer the questions that follow.



- Compare the curves for temperature within the compost heap and maximum air temperature.
- Account for the trend in temperature within the compost heap over time of heap incubation
- Discuss the effects of heat generated by the rotting material.
- (i) How do fungi differ from plants?  
(ii) Suggest ways how the parasitic fungus *Phytophthora infestans* suits its establishment.
- Explain the;  
(i) ecological role of saprotrophism. (ii) economic importance of recycling in agriculture. **St. Mary's college Kisubi**

28. Figure 1 shows the energy continuum during time of exercise from its onset and figure 2 below shows the changes in relative tension in a skeletal muscle (sarcomere) as it contracts.

Figure 1

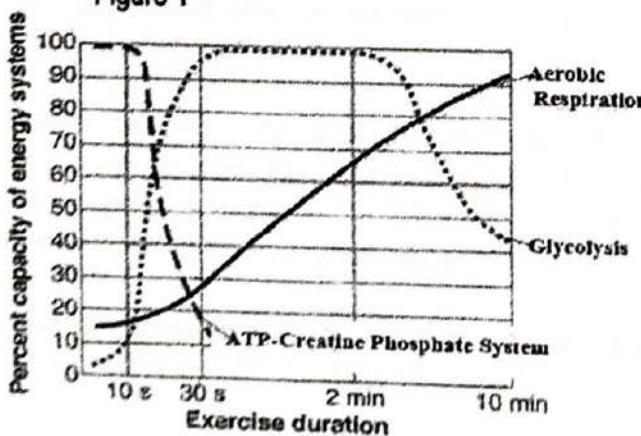
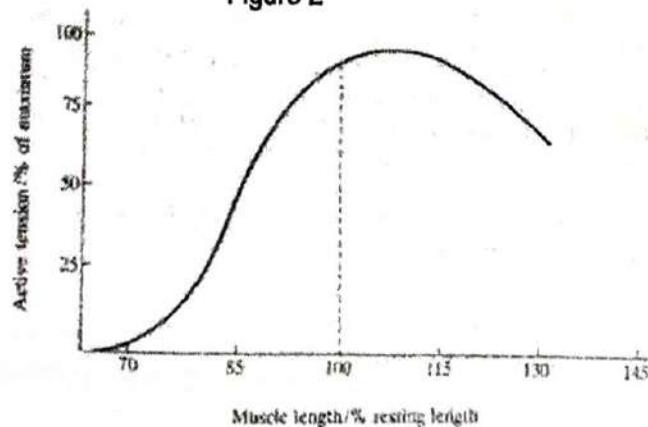


Figure 2



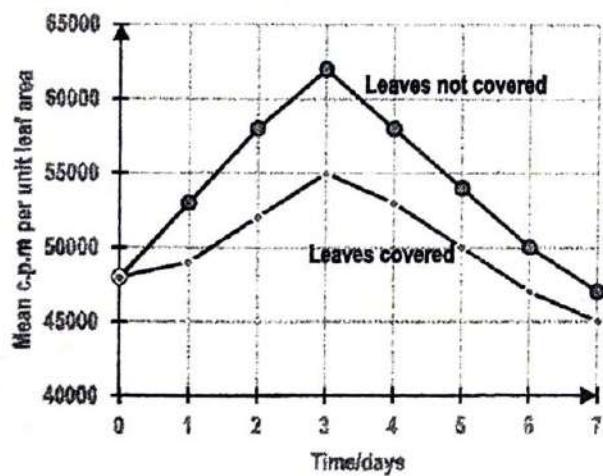
a) i) What conclusions can be drawn from the figure 1? ii) Account for the trend in energy use during the time of exercise as shown on the graph in figure 1.

b) i) Give an account of the changes in tension of skeletal muscle (sarcomere) in figure 2. ii) How are skeletal muscles suited for their function? **Kawanda ss**

29. a) (i) Explain why a double circulatory system enables mammals to have a high metabolic rate.

ii) Atropine is a drug that can be used to treat some forms of bradycardia leading to increase in heart rate. Explain how this result. b) (i) Describe how exercise leads to the stimulation of the cardiac centre in the medulla oblongata. (ii) State the changes that occur in a human being during diving. (c) Explain how atherosclerosis can cause coronary heart disease and eventually death. **RINES HIGH SCHOOL**

30. An experiment was carried out to investigate the movement of phosphate in bean plants. Twelve intact plants were placed for 24 hours with their roots immersed in a nutrient solution containing phosphate labelled with radioactive phosphorus ( $^{32}\text{P}$ ). The plants were then transferred to a non-radioactive nutrient solution. The leaves of six plants were covered with aluminium foil to exclude light. The mean radioactivity for the six plants in each group present in the leaves of all twelve plants was measured in terms of counts per minute (c.p.m) over a period of seven days. The results are shown in the figure below.



a) Compare the mean radioactivity for the two groups of plants.

b) Account for the difference in the mean radioactivity of the two groups of plants.

c) Briefly explain;

(i) The route taken by  $^{32}\text{P}$  from the nutrient solution to the leaves.

(ii) Why six plants were used for each treatment?

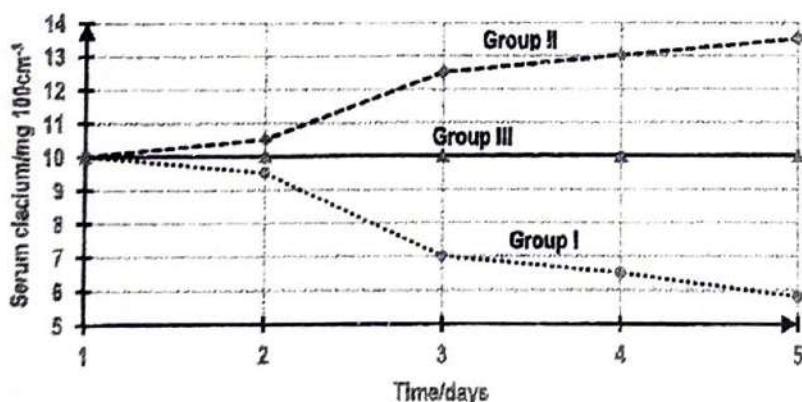
(iii) Why the amount of  $^{32}\text{P}$  continued to increase in the leaves even though the plants had been transferred to the non-radioactive solution?

d) What would the effect of;

(i) Exposing the plants to moving air on the amount of  $^{32}\text{P}$  accumulated in the leaves.

(ii) The darkening on the amount of starch and soluble sugars in the covered leaves. **OUR LADY OF AFRICA NAMILYANGO**

31. An experiment was carried out to investigate on the concentration of blood calcium using three different groups of people. Group I had hyperparathyroidism, Group II had their parathyroid gland surgically removed (parathyroidectomy) and Group III was the control whose parathyroid gland was functioning normally. The concentration of calcium ions in normal human blood serum ranges between 9 and 11 mg per  $100\text{cm}^3$ . The results of the experiment are shown in the figure below.



a) Compare the concentration of serum calcium for individuals in group I and II

b) account for the observed concentration of serum calcium in the three groups.

c) During the last two days of the experiment, individuals in group I experienced tetany. Briefly explain what is meant by the term tetany?

d) Suggest what can be done to the individuals in group I to overcome the situation experienced during the last two days of the experiment.

e) state how the serum calcium concentration would vary in an individual with a malfunctioning parathyroid gland.

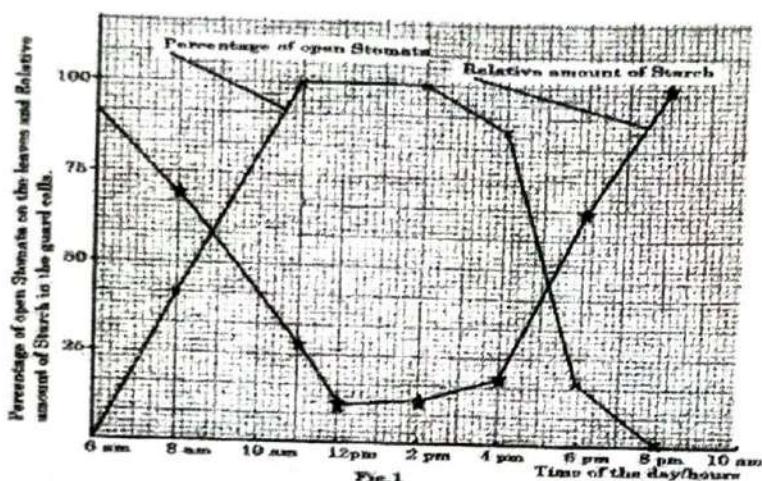
f) Briefly explain why skeletal fractures and breaks are more likely in older women than in men of the same age? **BLESSED SACRAMENT SS KIMAANYA**

32. The figure below shows the results of an investigation on the effect of the relative amount of starch in the guard cells of the leaves on the percentage of open stomata on the leaf of C<sub>4</sub> plants.

a) Describe the relationship between percentage of open stomata and relative amount of starch.

b) Explain the effect of each of the following on the percentage of the open stomata on the leaves.

i) Relative amount of starch in the guard cells (ii) Time of the day.



33. An Arabian camel, storing fat mainly in its hump weighs 400kg and lives in deserts where the temperature by day often 40°C. The fat in the camel's hump weighs 40kg and is a source of metabolic water. The table shows the day temperature, oxygen content and water content of desert air and air expired from the camel's lungs.

Type of air	Temperature (°C)	Oxygen content (cm <sup>3</sup> dm <sup>-3</sup> )	Water content (mgdm <sup>-3</sup> )
Desert air	40	200	5
Expired air	37	160	44

b) describe the strategy used by the camel to ensure that most of the water in air expired from lungs is not lost to the environment.

c) compare the proportion and distribution of fat in the camel and the human. d) what is the significance of the differences in (c) above to each of the mammals in their habitat. e) The concentration of urine produced by a camel can twice that of a human. Suggest how the structure of the camel's kidney is adapted for producing such greater urine concentration. g) state the significance of ectothermic behaviour of camels.

f) Explain the significance of the variation of the; i) body size ii) body extremities between the temperate and desert mammals **SEETA HIGH SCHOOL GREEN CAMPUS**

34. An investigation was carried out to determine variation in lung volumes and lung capacities under different conditions among individuals in a suburb of Kampala. Figure A compares the volume of air breathed out in non-smokers and the smoke addicts who have practiced the habit for over twenty years. Figure B shows the volume air in the lungs of a healthy individual at rest as recorded by a spirometer.

Figure A.

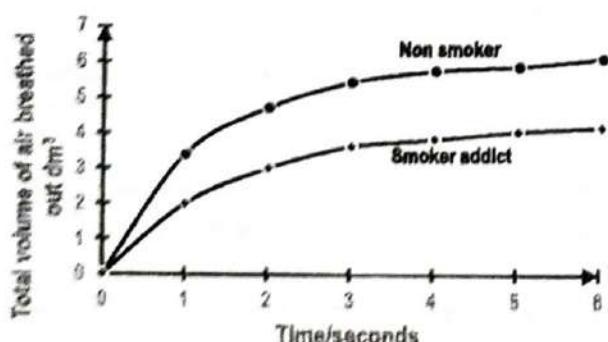
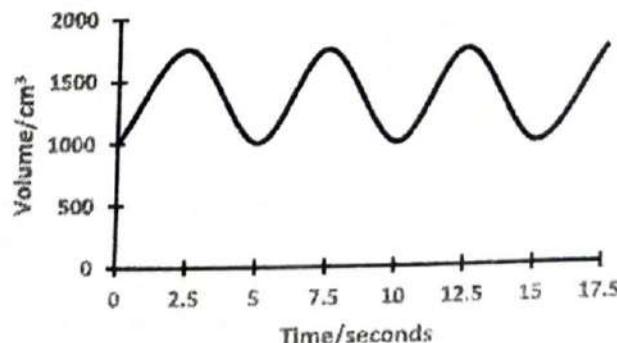
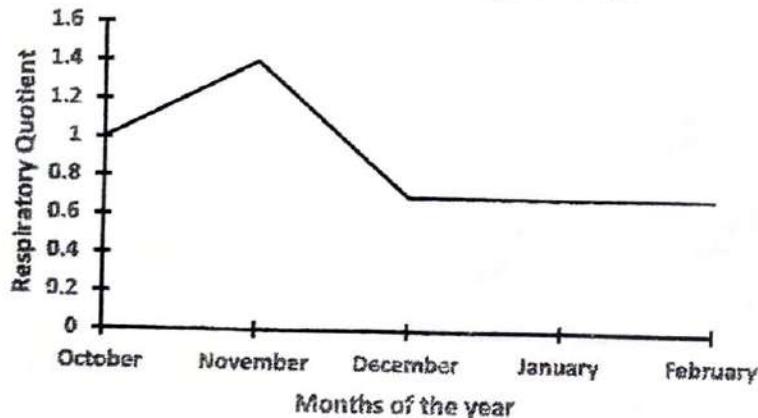


Figure B



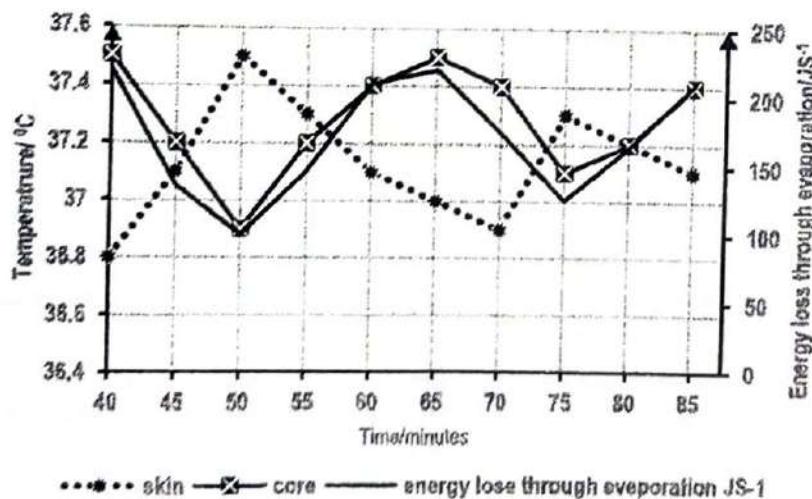
a) From the spirometer trace given above, determine:(i) Breathing rate (ii) Tidal volume (iii) Pulmonary ventilation

- b) Sketch a spirometer tracing that would be obtained if the individual got engaged in an exercise a.  
 c) Explain the difference observed with onset of exercise  
 d) What effect would an increase in carbon dioxide concentration have on the ventilation rate?  
 e) Describe the physiological mechanism by which the effect is brought about and state its significance.  
 f) Describe how muscle action causes the changes in figure A  
 g) Explain the difference in volume of air breathed out between the smoker and non-smoker  
 h) An experiment was carried out to determine the respiratory quotient of a hedgehog during different seasons and the values obtained were represented on the figure below.



Autumn season (October to November) and winter season (November to February)  
 i) Account for the variation of respiratory quotient in autumn and winter  
 ii) State any two conditions in plants where RQ values similar to those in autumn can be obtained.  
 iii) State the importance of respiratory quotient values BUDDO SS

35. A special calorimeter was developed into which an adult nude male volunteer was kept initially at 45°C. Both surface and core temperatures rose initially but stabilised within 15 minutes. Forty minutes after entering the calorimeter, he was given a quantity of iced water to drink. This was repeated 30 minutes later. Measurements of surface temperature (skin) and core temperature, and of body heat lost due to evaporation were taken at five-minute intervals after the initial cold drink and the results were plotted on a graph as shown below.



- a) Describe the relationship between:  
 i) Core temperature and sweating  
 ii) Core temperature and energy loss through evaporation, between the two times of ice intake  
 b) Account for the relationship in a(ii) above  
 c) Explain how the initial rise in surface and core temperatures was stabilized  
 d) Explain the role of the following in temperature regulation:  
 e) Human skin (ii) Counter current heat exchange mechanism in the limb  
 f) Compare temperature regulation in plants and animals

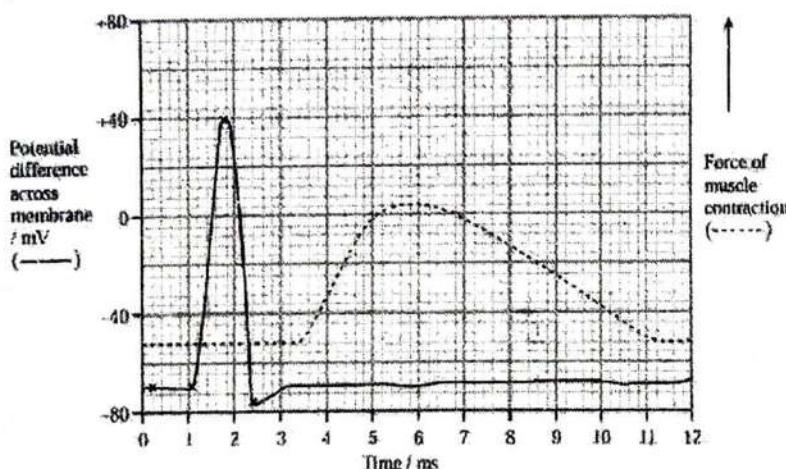
- g) Explain the importance of temperature regulation to an organism  
 f) Suggest why body temperature is regulated mainly by negative feedback and not positive feedback KITENDE SS  
 36. (a) State Mendel laws of inheritance and explain how meiosis illustrates these laws. b) Distinguish between complete linkage and incomplete linkage  
 (c) When two phenotypically wild type *Drosophila* with long wings and red eyes are crossed, two mutant phenotypes; curved wings and lozenge eyes are seen to segregate among the progeny as follows. Females: 600 long winged red eyed, 200 curved wings, red eyed. Males: 300 long winged lozenge eyed, 100 curved winged red eyed and 100 curved winged lozenge eyed. What is the genetic nature of; i) curved wing mutant (ii) Lozenge eye mutant (iii) Female parent (iv) Male parent.  
 (d) Using appropriate symbols, explain these results. (e) Describe the causes of deviation from Mendel's guidelines of inheritance NAALYA SS BWEYOGERERE

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

Wave length(nm)	Amount of light absorbed as a percentage of maximum		
	Red cone	Green cones	Blue cones
660	5	0	0
600	75	15	0
570	100	45	0
550	85	85	0
530	60	100	10
500	35	75	30
460	0	20	75
430	0	0	100
400	0	0	30

- a) From the data, explain why light of wave length:
  - i) 430nm appears blue.      ii) 550nm appears yellow
  - iii) 570nm appears orange.
- b) Explain why two closely placed small objects can easily be distinguished by cones than rods.
- c) Compare the suitability of the mammalian eye and the compound eye in;
  - i) light sensitivity.      ii) visual acuity.      iii) detecting flickering such as objects on a TV screen.
- d) i) Explain how an image is perceived by the human brain across a rod cell.    ii) Use the human eye to explain the term dark adaptation **SEETA HIGH SCHOOL MAIN CAMPUS**

38. In an investigation, an impulse was generated in a neurone using electrodes. During transmission along the neurone, an action potential was recorded at one point on the neurone. When the impulse reached the neuromuscular junction, it stimulated a muscle cell to contract. The force generated by the contraction was measured. The results are shown in the graph. The distance between the point on the neurone where the action potential was measured and the neuromuscular junction was exactly 18 mm.



- (i) On the curve for muscle contraction, identify the three phases shown
- (ii) Suggest explanation for the phases identified in (a) (i)
- (iii) Use the graph to estimate the time between the maximum depolarization and the start of contraction by the muscle cell.
- (iv) Use your answer to part (i) to calculate the speed of transmission along this neurone to the muscle cell. Give your answer in mm per second. Show your working.
- (v) Give one reason why the value

calculated in part (iii) would be an underestimate of the speed of transmission of an impulse along a neuron.

(b) Acetylcholine is the neurotransmitter at neuromuscular junctions.

(i) Describe how the release of acetylcholine into a neuromuscular junction causes the cell membrane of a muscle fibre to depolarize. (ii) Explain the effect of drugs on the synaptic transmission

(c) Use your knowledge of the processes occurring at a neuromuscular junction to explain each of the following.

(i) The cobra is a very poisonous snake. The molecular structure of cobra toxin is similar to the molecular structure of acetylcholine. The toxin permanently prevents muscle contraction.

(ii) The insecticide DFP combines with the active site of the enzyme acetylcholinesterase. The muscles stay contracted until the insecticide is lost from the neuromuscular junction. **KYADONDO SS**

39. After moving from bright light into darkness, it takes several minutes for the rod cells to recover their sensitivity.

Researchers measured the ability of the rod cells to detect small spots of light of different colours and intensity after a person moved into darkness. The results are shown in Figure 1. Figure 2 shows the amount of light of different wavelengths that rhodopsin absorbs.

(a)(i) Explain why it takes time for the rod cells to recover their sensitivity to light after moving into darkness.

- ii) Use information in Figures 1 and 2 to explain the differences in sensitivity of rod cells to red and green light.  
 iii) Suggest an explanation for the difference in sensitivity of rod cells to the white and green spots after 30 minutes.

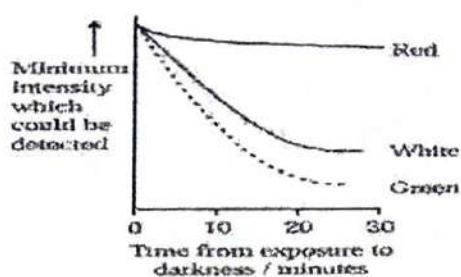


Figure 1

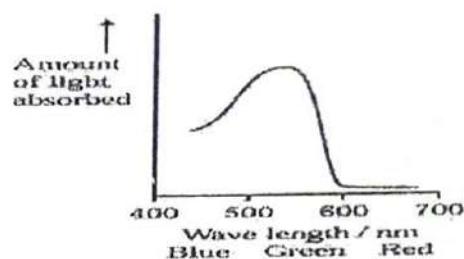
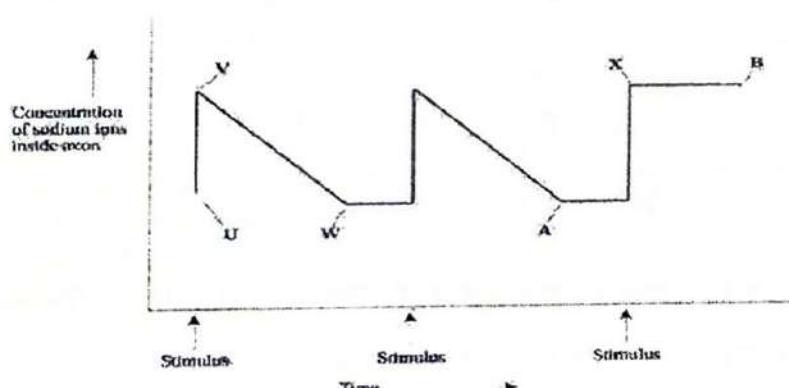


Figure 2

- b) The graph below shows changes in concentration of sodium ions inside the axon of a large neurone. The axon was stimulated at the points indicated on the graph. Between A and B on the graph the neurone was treated with dinitrophenol. This prevents the reduction of ATP



- (a) Explain the changes in sodium ion concentration  
 (i) between U and V;  
 (ii) between V and W.  
 (ii) Explain why the concentration of sodium ions did not change between X and B. NAKANYONYI SS

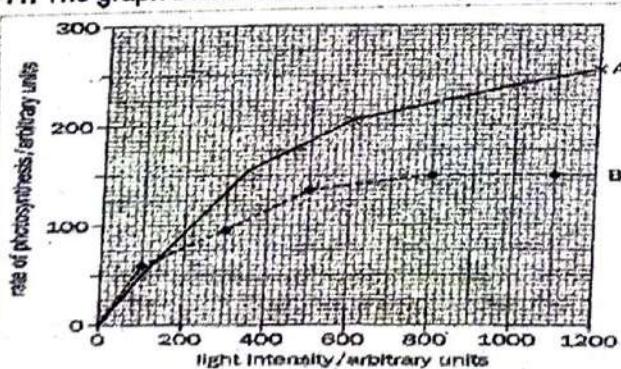
39. a) What does it mean by alternation of generation? b) Describe the significance of alternation of generation to the life cycle of plants. c) How are ferns better adapted to live on land than mosses? d) Outline the challenges land plants had to overcome in order to increase their independence from water. e) Explain the genetic significance of sporophyte generation being the dominant generation in flowering plants.

f) State the distinguishing features of angiosperms. g) i) Describe how a gametophyte forms a sporophyte in a moss. ii) Explain why the fern species cannot survive entirely in dry environment. (iii) Briefly explain why the gametes produced by a mammal are genetically different while those produced by a fern are usually genetically identical. ST. BALIKUDDEMBE SS  
**MITALA MARIA**

40. (a) (i) What physiological features suit human parasites to their mode of life. (ii) Describe the life cycle of the common malaria parasite. b) (i) Explain why old antimalarial drugs such as quinine and chloroquine seem ineffective in treating malaria than they were before unlike novel drugs like artemisinin. (ii) Describe the biological factors that make malaria a difficult disease to control.

c) Account for the fact that malaria-infested regions of the world are associated with a comparably high frequency of the sickle cell gene. **CORNERSTONE LEADERSHIP ACADEMY**

41. The graph below shows the rate of photosynthesis in two crop plants A and B at different light intensities.



- a) Describe the ways in which increasing the light intensity has; (i) Different effects on the two crops. (ii) Similar effects on the two crops.  
 (b) Suggest the most likely limiting factor for crop B at a light intensity of; (i) 100 arbitrary units. (ii) 1000 arbitrary units.  
 (c) Explain how C4 and CAM photosynthesis improve upon C3 photosynthesis.  
 (d) Describe the effects of light on abundance and morphology of plants. **MENGO SS.**

42. a) Explain how modifications of plant organs provide support. b) Describe the significance of secondary thickening in plants. c) Describe the formation and function of; (i) lenticels. (ii) Annual rings  
d) How does red light induce various processes of growth in particular plants?  
e) State the functions of each of the following in the life cycle of an organism.

i) Cleidoic egg (ii) Coelom (iii) Bilateral symmetry (iv) Metameric segmentation PRIDE COLLEGE MPIGI

- 43.a) Describe the role of changes in PH in transport of respiratory gases.  
b) Explain the physiological changes that may occur in humans under each of the following conditions; i) just before exercise. ii) during the race  
c) i) With reference to the functioning of arteries, explain how blood flow to organs such as the kidneys is decreased during strenuous exercise.

Organ	Blood flow at rest/cm <sup>3</sup> min <sup>-1</sup>	Blood flow during strenuous exercise/cm <sup>3</sup> min <sup>-1</sup>
Skeletal muscles	1200	12500
Skin	500	1900
Kidneys	1100	600
Intestine	1400	600
Others	1600	1000
Total	5800	17500

- ii) Suggest explanations for the pattern of changes in the blood flow to the organs during strenuous exercise.  
iii) The skeletal muscle respires much more rapidly during strenuous exercise. Explain how this results in oxyhaemoglobin unloading more oxygen to the tissue.  
iv) What is the significance of red blood cells being impermeable to cations?

ST. JOSEPH NANSANA SS

44. The diagram below shows the sequence of bases in one strand of the DNA from part of a gene. The base sequences are read from left to right.

A	C	C	C	C	A	T	T	T	C	A	T	C	C	A
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

The below shows the anti-codons of some tRNA molecules and the specific amino acids each would carry.

- a) Using this information, write down the amino acid sequence coded for in this part of the gene.

The figure below shows same length of DNA after it has undergone a mutation.

Amino acid	tRNA Anti-codon
Alanine	CGA
Glycine	CCA
Lysine	UUU
Proline	GGA
Tryptophan	ACC
valine	CAC

- a) Using this information, write down the amino acid sequence coded for in this part of the gene.

The figure below shows same length of DNA after it has undergone a mutation.

A	C	C	T	C	A	T	T	T	C	A	T	C	C	A
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

- b) Describe how the polypeptide chain produced from this mutation may differ from the normal polypeptide.

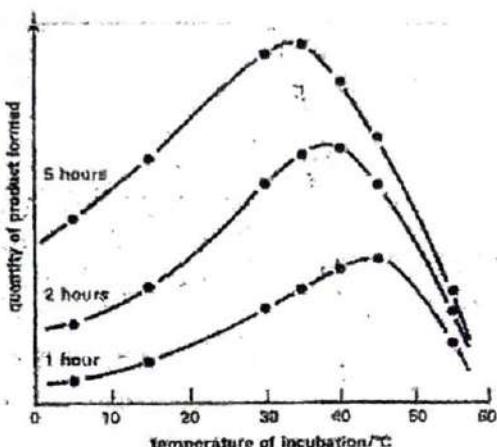
c) The sequence of bases shown below represents a short length of mRNA copied from a given DNA cistron. AUGGCCUCG AUCACGGCCACCAUGUAG. The amino acid Isoleucine is coded for by the following codons; AUU, AUC and AUA. What is the maximum number amino acids in the polypeptide for which this mRNA would code if it is; (i) non overlapping (ii) maximum overlapping

- d) Write the; (i) DNA sequence from which the mRNA was transcribed (ii) Anticodon sequence for codons 3 and 9

- e) Explain the effect of substituting the last nucleotide of the 4<sup>th</sup> codon with adenine on the nature of polypeptide formed from the above mRNA transcript when the code is; (i) Non overlapping (ii) Maximum overlapping. f) Explain why continuous and discontinuous DNA synthesis occurs in the 5' to 3' direction with respect to the newly formed strand. g) Describe the adaptations of tRNA molecule to its function. (h) State the importance of mutation.

- (i) Explain how mutation led to evolution of a new species by natural selection BULO PARENTS SS

45. The graph below illustrates the relationship between time, temperature and the amount of product formed in an enzyme-catalysed reaction. In the experiment, the samples were incubated at different temperatures for periods of 1, 2 and 5 hours. The quantities of products formed were then determined.



(a) i) Describe the effect of increasing the incubation temperature on the quantity of product formed, as shown by any one of the curves presented in the graph above.

(ii) Explain the effect of increasing the incubation temperature on the quantity of product formed described above.

(b) i) state the optimum temperature for the curves below.  
1 hour; 2 hours; 5 hours

ii) Explain why the optimum temperature is higher if the quantity of product formed is measured after 1 hour rather than after 5 hours.

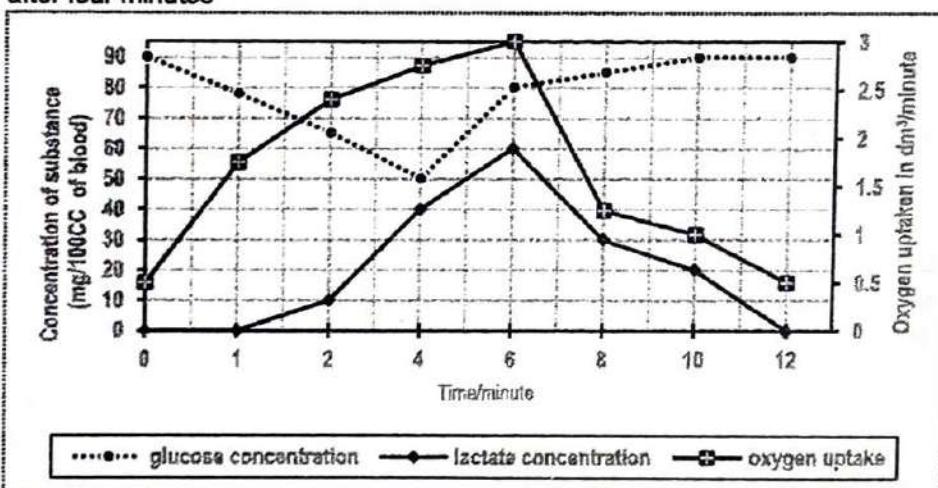
c) Describe how the non-competitive inhibitors result into a reduction in the rate of reaction for an enzyme-controlled reaction. **BUSOGA COLLEGE MWIRI**

46. (a) Explain how a gene mutation can have; i) a positive effect on the individual. ii) no effect on the individual.

(b) Describe the significance of non-disjunction in sexual reproduction. **ST. HENRY'S MBALWA**

47. (a) Explain how; (i) the fovea enables an eagle to see its prey in detail. (ii) distribution and arrangement of photoreceptors of retina enables an owl to hunt its prey at night. (b) Give an account of the adaptation of receptors and the significance of this phenomenon **GREENLIGHT ISLAMIC NANSANA**

48. a) What is meant by the term oxygen debt. b) The graph below shows the variation in the glucose concentration, lactate concentration in blood and oxygen uptake with time of exercise of a normal non athletic individual. The exercise stopped after four minutes



Compare the variation in lactate concentration with; i) glucose concentration. ii) oxygen uptake. c)

Describe the relationship between oxygen uptake and; i) lactate concentration. ii) glucose concentration.

d) Account for the relationships described in (c) above

e) (i) State and explain how the lactate concentration would vary if an endurance athlete was used.

(ii) Explain why the concentration of creatine phosphate decreases immediately after the start of an exercise? **TRINITY COLLEGE NABBINGO**

49. a) What is the advantage of panting over sweating in temperature regulation.

b) Explain how panting result in the following conditions in the body of an organism; (i) alkalosis. (ii) increased heat production. c) Explain the effect of hyperventilation on an organism.

d) (i) Differentiate between the counter current multiplier effect and counter current heat exchanger.

(ii) Discuss the significance of the different counter current systems in organisms. **JINJA COLLEGE**

50. (a) what is meant by the term cavitation? (b) Describe the modification of Munch's theory of translocation.

(c) Describe stomatal movement basing on mineral ion change theory.

(d) What are the evidences to reflect that active movement of sugars within the sieve tube is based on the activity of the companion cells?

(e) Suggest a mechanism by which rise in abscisic acid concentration leads to closure of stomata. **ST. HENRY'S COLLEGE NAMUGONGO**

51. (a) What is meant by each of the following? (i) Polymorphism. (ii) Industrial melanism.

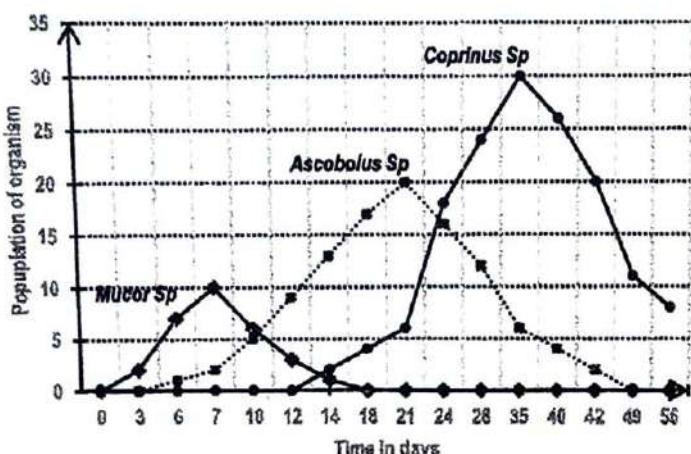
(b) Differentiate between transient and balanced polymorphism. (c) Outline the causes of polymorphism in a population.

(d) What is the role of polymorphism in evolution of organisms of a given a population? **VIENNA HIGH SCHOOL KABOWA**

Despite having low metabolic rate, fish have a higher ventilation rate than terrestrial organism of the same surface area to volume ratio. (e) Discuss the adaptations of diving mammals. **NAMILYANGO COLLEGE**

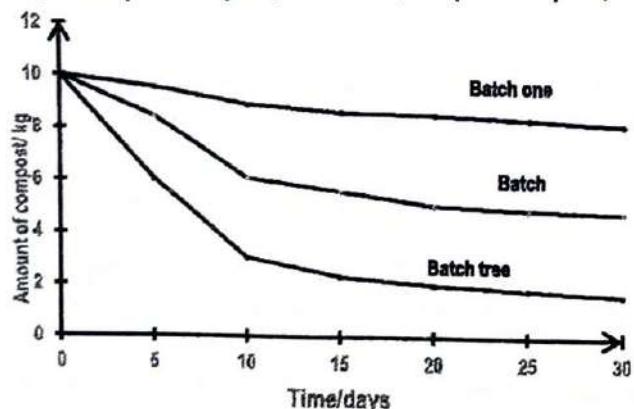
13. The figure below shows the findings of an investigation carried out to determine the variation in the population density of three different forms coprophilous fungi flourishing on herbivorous dung in their successional trend. Table 1 shows the nutritional requirements of the fungi species used in the investigation.

Fungi species	Nutritional requirements
Mucor Sp.(phycomycetes)	Feed on sugars, amino acids, fatty acids, glycerol, starch, proteins and fats
Ascobolus Sp.(ascomycetes)	Feed on cellulose, and hemicellulose
Coprinus Sp.(basidiomycetes)	Feed on lignified structures (fibres and xylem vessels) in the dung



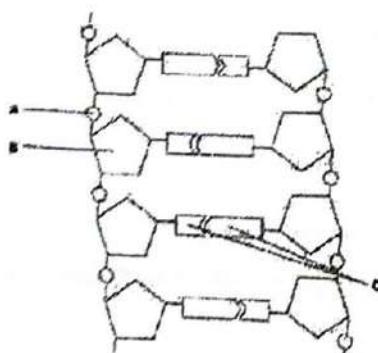
- a) Describe the variation in population of the following fungal species. (i) *Mucor Sp.* (ii) *Coprinus Sp.* (iii) *Ascobolus Sp.*
- b) Account for the variations in the population density for each of the fungal species in (a) above.
- c) Briefly explain the nutritional and environmental factors that determine the success of saprotrophic fungi with a named example.
- d) Discuss the ecological importance of saprotrophic fungi. **ENTEBBE SS**

14. The graph below shows the results of an experiment carried out to investigate the rate of decomposition of garden waste in three different settings. Three different categories of compost were used in the experiment and treated as follows. Batch one; unheaped compost, batch two; heaped compost, batch tree; finely chopped heaped compost.



- a) Compare the rate of decomposition of garden waste for batches; i) One and three (ii) Two and three
- b) (i) Explain the differences in the rate of decomposition observed in batch two and three
- ii) Explain the effect of burying garden waste on the rate of decomposition.
- c) Explain the significance of hydra exhibiting both extracellular and intracellular digestion. **BUWEMBO SEED SS**

15. DNA is the hereditary material that has instructions that direct protein synthesis. During the cell cycle the molecule replicates and during this time, mistakes are bound to happen however, they don't happen and if they do happen, they're very few. The figure below shows a part of DNA molecule. Study it and answer the questions that follow.



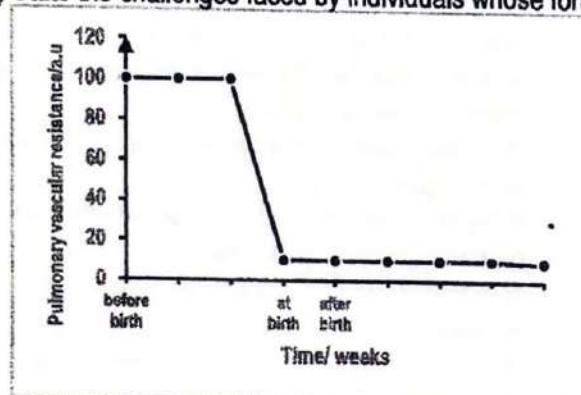
- a) Name the structures represented by letters A, B and C and state the structural characteristics of DNA based on the image
- b) State how structure B would differ in an HIV virus genome
- c) Why does the molecule replicate prior to cell division?
- d) State how mistakes (mutations) are minimized during replication
- e) In an experiment to investigate the type of mutation caused by a certain mutagen X, it was found out that treating X with a certain DNA piece reduced its length. If the DNA remnant has 40 base pairs of which, TAC and ATT were among the codons present,

- i) determine the maximum numbers of Amino-Acids you would expect to find in a protein formed from such DNA.  
 ii) Assuming the normal polypeptide chain is composed of 40 different Amino-Acids, explain how this mutation may affect the functionality of the formed protein. Make an assumption that the normal protein forms Ach receptor. Explain why this type of mutation might be more dangerous than that involving single base substitution. **LUGAZI HOMESTONE SCHOOL**

15. a) Distinguish between environmental stress and physiological drought.  
 b) Explain how plants overcome the following forms of environmental stress  
 i) biotic stress (ii) abiotic stress  
 c. Identify the different forms of positive/positive (+/+) relationships exhibited by plants and explain their significance to the plants. **KABOWA HIGH SCHOOL**

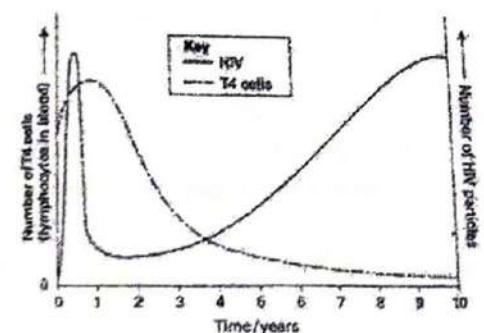
16. The figure below shows changes in pulmonary vascular Resistance (PVR) in the lungs of a human being before and after birth.  
 a) Describe the changes in PVR with time  
 b) Explain the difference in PVR between the fetus and the baby  
 c) Explain why blood does not flow from the left side of the heart to the right side of the heart after birth yet it does flow from the latter to the former in fetal stage.

- d) State the challenges faced by individuals whose foramen Ovale (FO) fails to close after birth.



- e) Other than the closure of the FO in the baby weeks after birth, state other changes you expect to have occurred during the same time frame.  
 f) State the significance of most of the blood bypassing the lungs and liver through ductus Arteriosus and Ductus venosus respectively.  
 g) Why should some blood flow to the lungs yet there is no oxygen nor carbon dioxide to be exchanged in a fetus? **MT. ST. MARY'S COLLEGE NAMAGUNGA**

17. CD4 (T4) are cells of the adaptive immune system that collaboratively work with other lymphocytes to fight against infections. They work by producing chemical messengers called cytokines and membrane bound protein which stimulate B cells to produce antigen specific antibodies which engage the innate immune system.



The figure below shows how the number of T4(CD4) and HIV particles change in an HIV patient withing a period of 10 years.

- a) Explain the relationship between T4 and the number of HIV particles  
 b) State how the T4 recognize the HIV Virus in this patient  
 c) From the graph,  
 i) state the challenge (s) HIV patients face after the 7<sup>th</sup> year of infection  
 ii) with the reason, state the time frame when the patient is least and most infectious.

**SEETA HIGH SCHOOL MBALALA CAMPUS**

18. In a certain mammal, X a cross between a male individual having normal eyes, small ears with a female individual having big ears and buggy eyes produced all offspring having big ears and buggy eyes. In another experiment, an F1 individual was crossed with an individual having small ears and normal eyes and the results from the experiment are shown in the table below.

Percentages	Genotype	Phenotype
48%		Big ears, buggy eyes
2%		Big ears, normal eyes
2%		Small ears, buggy eyes
48%		Small ears, normal eyes

- a) Based on the results in the table, calculate the phenotypic ratio of the offspring  
 b) With the help of genetic symbols, explain how such a phenotypic ratio arises.  
 c) Determine the genotypes of the all the offspring in the table  
 d) Determine the distance between the genes for ear size and shape of the eye. **PASSION CHRISTIAN HIGH SCHOOL**

- 19.a) what is meant by the term an escape response in animal behaviour

- b) Distinguish between the following terms as used in animal behaviour

solution	Contents	ATPase activity/arbitrary units
A	ATP, myosin and actin	1.97
B	ATP, myosin, actin and tropomyosin	0.54
C	ATP, myosin, actin, tropomyosin and calcium ions	3.85

i) Explain the importance of ATPase during muscle contraction.

ii) Explain the difference in the results between; A and B; B and C. **MIDLAND KAWEMPE**

7. Methanol is a substance that is used as a fuel in cars and trucks. If accidentally swallowed, it enters into body cells and gets converted into poisonous formaldehyde and formic acid catalysed by dehydrogenase enzyme. The same enzyme can catalyse breakdown of ethanol to ethanal in living cells. In an investigation carried out on body cells of a person who had accidentally swallowed methanol, the rate of formation of formaldehyde and ethanal was measured when the cells were treated with varying concentrations of ethanol. A graph was then plotted as shown in figure 1 below.

Figure 1

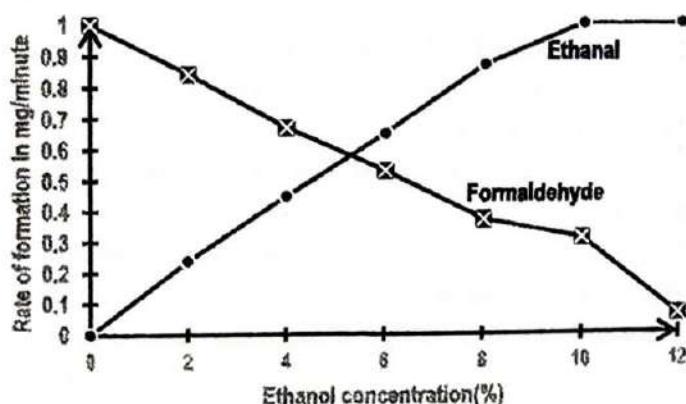
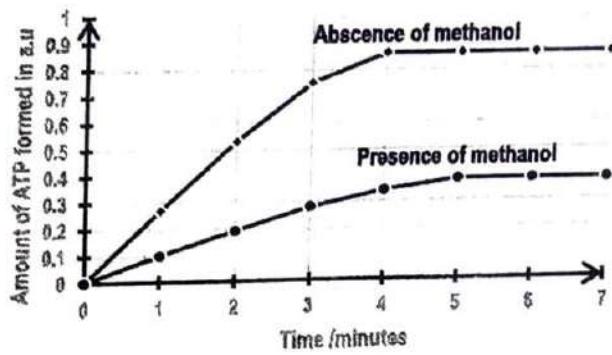


Figure 2



a) Compare the rates of formation of formaldehyde and ethanal.

b) Suggest an explanation for the observed effect of ethanol concentration on rate of formation of ethanal.

c) In another investigation, the amount of Adenosine Triphosphate (ATP) formed in a person's cells was measured in both presence and absence of methanol. A graph was then plotted as shown in figure 2 above.

i) Account for the physiological significance of the difference in observed changes in amounts of ATP recorded in presence and absence of methanol.

ii) From the investigations made, state how a person can be saved from methanol poisoning. Give a reason for your answer.

d) Describe how ATP can be produced from ethanol in living cells. e) Discuss the various categories of enzymes.

f) With examples, describe the roles of different types of co-factors in metabolic pathways. **KIBULI MUSLIM SS**

8. Roughly 60% of the mass of the body is water and despite wide variation in the quantity of water taken in each day, body water content remains incredibly stable. One hormone responsible for this homeostatic control is vasopressin.

a) (i) What is meant by the term diuresis. (ii) Describe the mechanisms that are triggered in the mammalian body when water intake is reduced.

b) The graph below shows how the plasma concentration of vasopressin hormone changes as plasma solute concentration rises

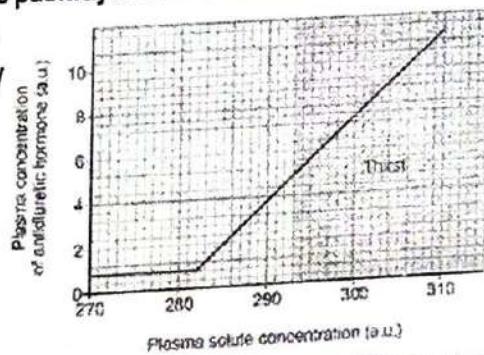
(i) Describe the relationship shown in the graph. (ii) Suggest why a person only begins to feel thirsty at a plasma solute concentration of 293 a.u

c) Secretion of vasopressin hormone is stimulated by decreases in blood pressure and volume. These are conditions sensed by stretch receptors in the heart and large arteries. Severe diarrhoea is one condition which stimulates vasopressin secretion. Suggest another condition which might stimulate vasopressin secretion.

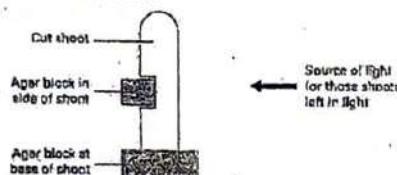
d) Explain the evolutionary significance of secretion of vasopressin hormone in living organisms. **KYABAZINGA COLLEGE KAMULI**

9. a) Explain the role of calcium ions in the following biological processes in living organisms.

(i) Stomatal closure (ii) Fertilization in humans (iii) Gravitropic response in root apex (iv) Synaptic nerve transmission



b) The diagram shows how movement of auxin through plant shoots was investigated. Shoots were removed from plants and each was placed on a block of agar. A second block of agar was placed in the side of each shoot where half of its tissue had been cut away. Samples of shoots treated in this way were left for several hours. Half the shoot was kept in darkness and half were left with a light source from one side. The concentration of auxin collected in the two blocks of agar from each shoot was measured. The table below shows the mean percentage of auxin found in the two blocks of agar from each shoot.



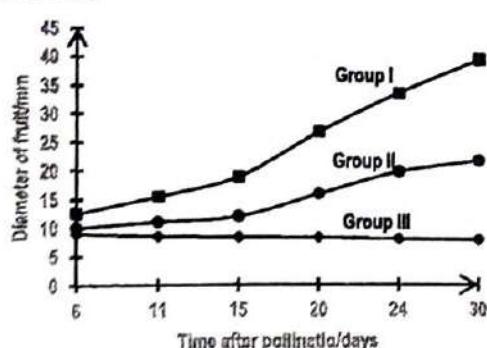
Location of block	Mean percentage of auxin collected in the two agar blocks from each shoot.	
	Shoot in dark.	Shoot lit from side
Side of shoot	27	35
Base of shoot	73	65
Both blocks	100	100

- i) What do the results of this investigation show about the movement of auxins?  
ii) Explain how the movement of auxins shown in this experiment enables intact plants to photosynthesize efficiently.

### MITYANA SS

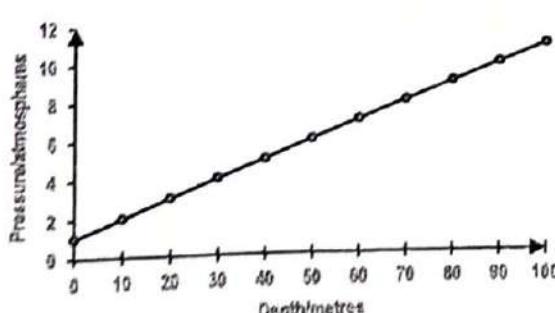
10. a) what is meant by the term lactational anovulation?  
b) Explain the significance of the following changes observed in the different classes in kingdom animalia.  
i) The avian embryonic hindgut rapidly expands forming an outgrowth which underlies the chorion within the cleidoic egg.  
ii) Milk production in lactating mother increases with frequent suckling of the young  
iii) Lysosomal activity of trophoblasts increases prior to implantation of the blastocyst.  
c) Compare embryo development in birds and mammals.  
d) Explain the different mechanisms used by mammals to increase their chances of fertilization. RISE AND SHINE HIGH SCHOOL

11. The figure below shows the effect plant growth substances (auxins) on the size of fruits. Three groups were considered in the experiment and treated as follows. Group I, achenes removed after pollination and not treated with auxins. Group II, achenes removed after pollination and treated with auxins. Group III, achenes not removed after pollination and not treated with auxins.



- a) Compare the changes in diameter of the fruit for the following groups  
i) II and III ii) I and III  
b) Explain the difference in the variations in the diameter of the fruit for groups. (i) II and III (ii) I and III  
c) Explain how a synthetic broad-leaved herbicide can be used to improve productivity in cereal crops.  
d) Explain how agriculturalists prevent preharvest fruit drop and state the advantage of the tendency of early fruit drop to a fruit tree.  
e) Explain how dandelion is naturally adapted for parthenocarpic fruit development. ST. HENRYS COLLEGE KITOVU

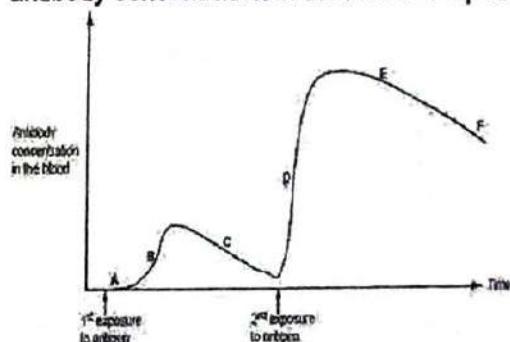
12. a). Distinguish between counter current and concurrent mechanisms in gaseous exchange.  
b) Describe the role played by peripheral chemoreceptors in controlling ventilation in man.



- c) The figure below shows the variation in pressure with increasing depth in the lake. Use it to answer the questions that follow. i) Describe the relationship between pressure and depth. ii) Explain the effect of the relationship described in (i) above on divers using a breathing apparatus with constant partial pressures of oxygen.  
d) Account for the significance of the following; i) Divers are advised to ascend slowly to the water surface from deep water bodies rather than rapid swimming. (ii) Inhalation being a more active process than exhalation in humans.

## UMSS NAMUGONGO 'A' LEVEL INTERACTIVE SEMINAR QUESTIONS SLATED 20<sup>TH</sup>/OCTOBER, 2024

1. Antigens on the surface of pathogens can provoke an immune response in a patient. The figure shows the changes in antibody concentration in the blood of a patient after exposure to the same antigen at different times.



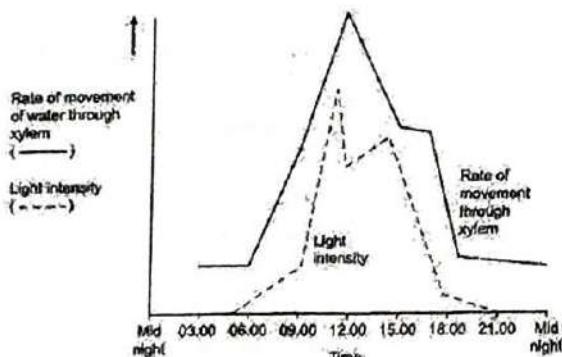
- a) What observations can be made from the graph?
- b) Give an explain for the shape of the curve as indicated by the letters.
- c) (i) On the same curve, sketch a different curve at time of second exposure to antigen; if a different antigen was administered at that time.  
(ii) Suggest explanation for curve sketched in (c) (i) above.
- (iii) Explain why jab of a given vaccine is administered several times to an individual.
- (d) Explain why many varieties of pathogenic bacteria are now resistant to a range of antibiotics.

(e) How is immunity naturally achieved by the human respiratory system?

f) Explain the basis for; (i) Blood group determination (ii) Blood transfusion **UMSS NAMUGONGO**

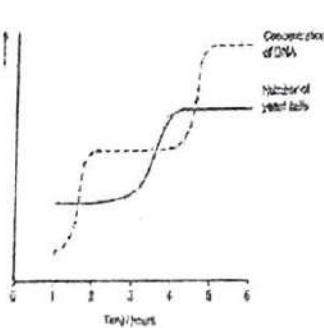
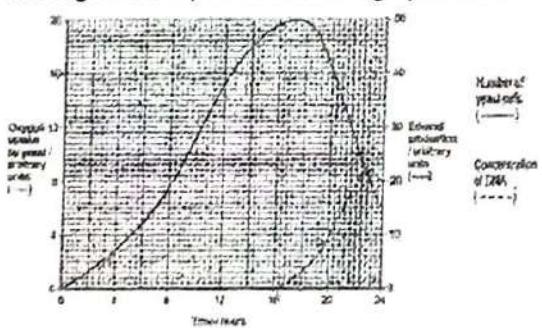
2. a) During transpiration, water diffuses from cells to the air surrounding a leaf. The rate of transpiration of a plant growing in a pot under different environmental conditions was measured. Their results are shown in the table.

Conditions		Transpiration rate/ $\text{gh}^{-1}$
A still air	15°C	1.2
B moving air	15°C	1.7
C still air	25°C	2.3



- i) Briefly describe how the rate of transpiration can be estimate
- ii) Suggest an explanation for the difference in the rate of transpiration in the different conditions.
- b) Scientists Investigated the rate of water movement through the xylem of a twig from a tree over 24 hours. The graph shows their results. It also shows the light intensity for the same period of time.
  - i). Describe the relationship between the rate of water movement through the xylem and the light Intensity
  - ii). Explain the change in the rate of water movement through the xylem between 06.00 and 12.00 hours.
  - iii) The scientists also measured the diameter of the trunk of the tree on which the twig had been growing. The diameter was less at 12.00 than it was at 03.00 hours. Explain why the diameter was less at 12.00 hours
- c). Discuss the role of each of the following in plants;
  - i). Hydathodes ii). Casparyan strip
- d) Arteries and arterioles take blood away from the heart. Explain how the structures of the walls of arteries and arterioles are related to their functions. **NDEJJE SS**

3. Yeast is one of the most important unicellular organisms belonging to kingdom fungi. A group of scientists carried out an experiment to investigate respiration in the population of yeast growing in a sealed container and the results of their investigation are presented in the graph below.

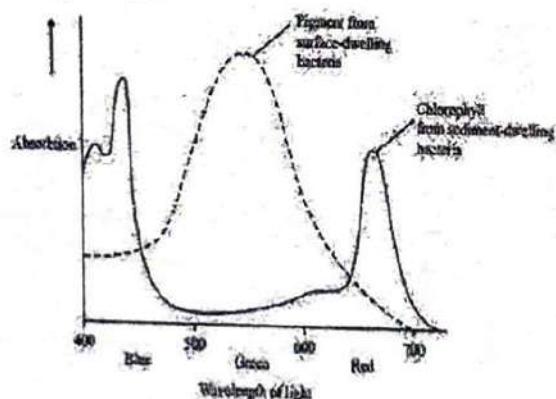


- a) Calculate the rate of oxygen uptake between 2 and 4 hours
- b) Account for the changes in oxygen uptake during this investigation
- c) Explain the changes in production of ethanol during this investigation
- d) Yeast is a single-celled eukaryotic organism. When yeast cells are grown, each cell forms a bud. This bud grows into a new cell.

This allows yeast to multiply because the parent cell is still alive and the new cell has been formed. Scientists grew yeast cells in a culture. They counted the number of cells present and measured the total concentration of DNA in the culture over a period of 6 hours. Their results are shown in the graph above. Explain the shape of the curve for the number of yeast cells; i) between 1 and 2 hours ii) between 3 and 4 hours.

e) Use the curve for the concentration of DNA to find the length of a cell cycle in these yeast cells. Explain how you arrived at your answer. **TRUST HIGH SCHOOL KABUBBU**

4. There is evidence that the first photosynthetic organisms were primitive water-dwelling bacteria. The very first of these lived near the surface of the water in lakes and contained a purple pigment that absorbed light most strongly in the green region of the spectrum.



Later, other bacteria evolved that lived on the top of sediment at the bottom of the lakes. Gene mutations had enabled these bacteria to synthesize chlorophyll instead of the purple pigment present in the bacteria living near to the surface. Chlorophyll absorbs light most strongly in the blue and red regions of the spectrum.

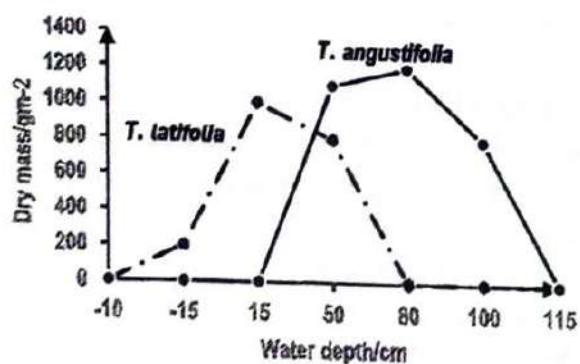
(a) Describe how light energy absorbed by chlorophyll molecules is used to synthesise ATP

(b) Use the figure to explain how natural selection would favour the evolution of sediment-dwelling bacteria containing a different photosynthetic pigment from those living near the surface of the water

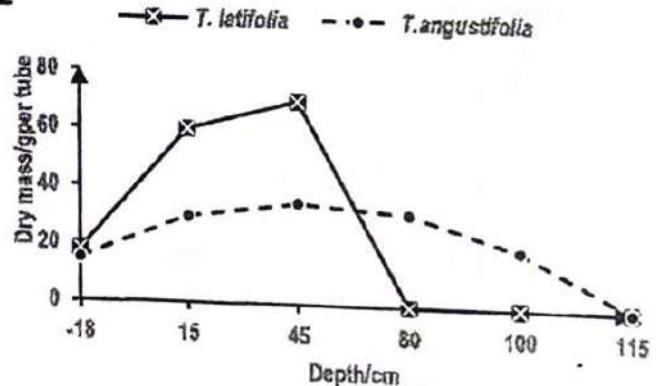
(c) Explain the evidence that shows that photosynthesis is a double stage reaction. **KINAAWA HIGH SCHOOL**

5. *Typha latifolia* and *Typha angustifolia* are plants that grow on the margins of ponds and lakes. Figure 1 shows the natural distribution of *T. latifolia* and *T. angustifolia* in the lakes. a) Compare the distributions of the two species within the lake. b) Figure 2 shows the results of an experiment in which species were planted separately in tubs, and placed at different depths in water to assess their growth. Explain the variation of the dry mass with the depth of the two species.

**Figure 1**



**Figure 2**



c) Explain the differences between the fundamental and realized niches of *T. angustifolia*.

d) Explain any two sampling techniques that can be used to investigate the distribution of plants at increasing depths of water from the shore of a lake. **MERRYLAND SS**

6. a) Distinguish between fast twitch and slow twitch muscles.

b) Describe how arrival of an action potential at the synaptic terminal of a motor neuron brings about muscular movements in animals.

c) Discuss how various forms of instabilities are overcome by fish during swimming.

d) There is an increase in the activity of the enzyme ATPase during muscle contraction. An investigation into muscle contraction involved measuring the activity of ATPase in solutions containing ATP, myosin and different muscle components. The table shows the results

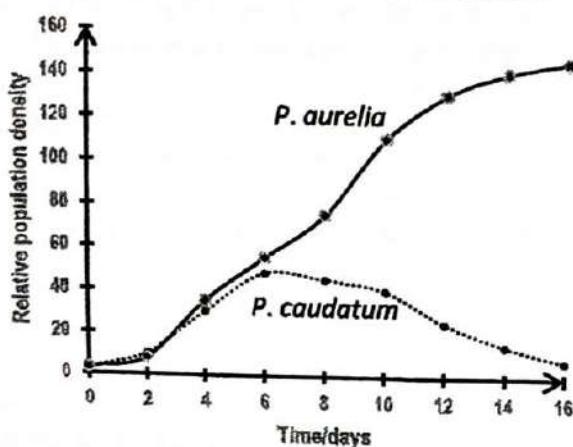
- (i) Motivation and motivating stimulus (ii) imprinting and imitation (iii) pheromones and hormones  
 c) with examples, explain the role of exogenous rhythms in animals  
 d) Account for the following observations made in animal behaviour. (i) learning new skills ceases in decorticate dogs and continue performing motor activities efficiently. (ii) Woodlice nocturnal activity diminishes with interruption of flashes of torch light. (iii) Amount of mRNA content increases in the cells of an organism during learning of new skills. **KAJJANSI**

### PROGRESSIVE SS

20. a) What is meant by term associative learning b) Compare the different forms of associative learning c) Explain the role of hypothalamus in animal motivation

d) Discuss the role played by pheromones in the following aspects of animal behaviour. (i) Reproductive behaviour (ii) feeding behaviour (iii) defensive behaviour (iv) maintenance of social organization. e) Explain how the following are minimized among organisms. (i) Mate cannibalism (ii) Fighting **VISION FOR AFRICA HIGH SCHOOL**

21. a) State the competitive exclusion principle. b) The figure below shows the results of an experiment conducted using two different species of paramecia in the same culture.

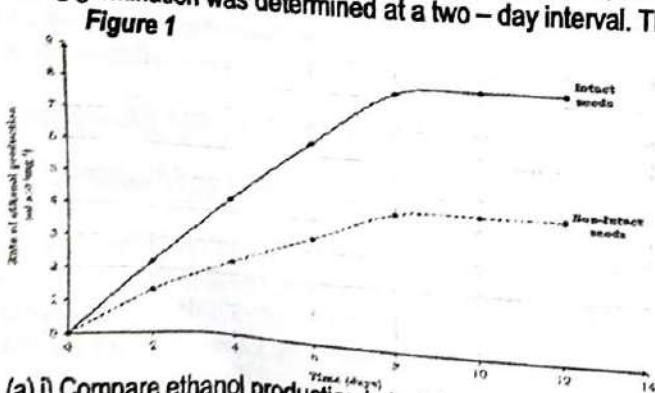


- (i) state the interaction between the organisms with reasons.  
 (ii) account for the difference in their maximum population density attained in the experiment.  
 (iii) explain the evolutionary significance of the relationship shown in the figure above.  
 c) briefly explain the conditions under which the competitive exclusion principle is modified.  
 d) (i) explain how the application of broad-spectrum pesticide results in pest resurgence.  
 e) The table below shows the number of deaths of predatory birds during different stages of their life cycle in an area that was sprayed with a broad-spectrum pesticide for an experiment conducted in wet season.

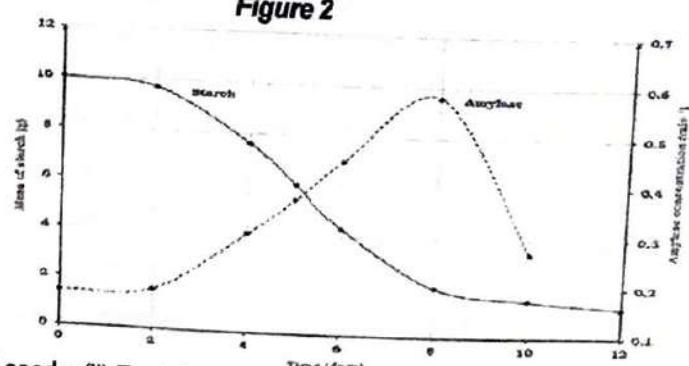
Life cycle stage	Number of deaths/months.
Juvenile	20
Reproductive (egg laying and incubation)	60

- i) Explain the difference in the death rate during the different stages in the predatory bird life cycle  
 ii) Another experiment was carried out during drought to establish the death rate of predatory birds in the same environment. State and explain how the death rate for both juvenile and reproductive stages would vary. **IGANGA GIRLS**  
 SS

22. A study was conducted on germinating maize seeds to determine the rate of ethanoic production by intact seeds and seeds whose testa were removed (non-intact seeds). The results are shown on figure 1 below. In another experiment using maize seeds in a green house, the changes in mass of starch and amylase concentration during germination was determined at a two – day interval. The results are shown on figure 2 below



- (a) i) Compare ethanol production in both intact and non – intact seeds. (ii) Explain the difference in the rate of ethanol production in figure 1 above.



(b) (i) Describe the variation in the amount of starch in the maize seedling. (ii) Explain the relationship between starch and concentration of amylase during; (1). the first 2 days (2). after 2 days. (c) Suggest and explain how the quotient of the two types of seeds in figure 1 would be compared.

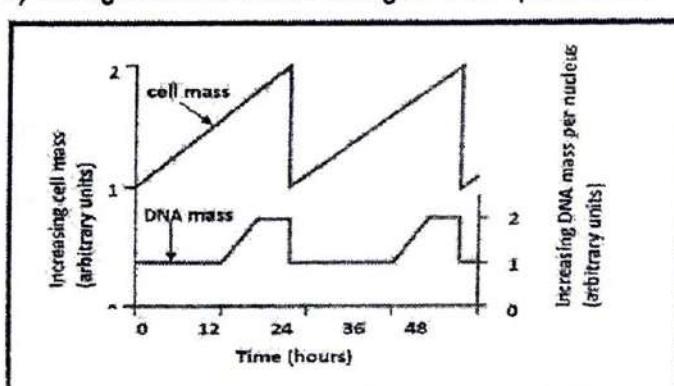
Explain why; (i) experiment 2 was conducted in a green house. (ii) many plants cannot tolerate prolonged synthesis of ethanol. (d) (i) From figures 1 and 2, what conclusion can you make about the physiology of germination in maize.

(ii) Name two internal factors that could affect the results of the second experiment. **SAVIOR HIGH SCHOOL**

### KIBOGA

24. In summer squash the fruits are either green or yellow. Yellow being dominant to green. Another gene responsible for colour deposition in recessive state otherwise when this gene is in dominant state, there is no deposition of colour in the fruit and the fruit is white. a) Explain the form of gene interaction above. b) Using genetic symbols, write the possible genotypes of yellow, green and white fruits. c) Work out the F<sub>2</sub> phenotypic ratios, if offsprings of a cross between double dominant variety of white fruits and green fruits were selfed.

d) The figure below shows changes in the quantities of nuclear DNA and cell mass during repeated cell cycle.



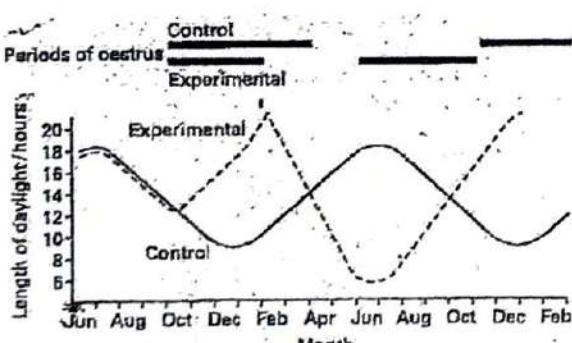
From the graph, deduce the number of cell cycles the cell has undergone with reasons.

- Compare the changes in the masses of DNA and the cell during 1 cycle.
- Explain the differences in the masses of DNA and the cell during 1 cycle.
- Explain the factors that cause the cell to divide.

**MT. ST. HENRY'S COLLEGE MUKONO**

25. The graph below shows the effect of light on the period of oestrus in two groups of Suffolk ewes (female sheep). Ewes in the control group were subjected to the normal seasonal variation in day length. Part way through the first year of the experiment, ewes in the experimental group were subjected to a reversed day-length cycle.

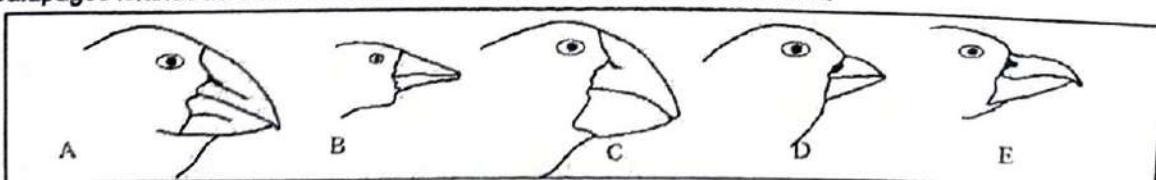
The period of oestrus of each group of ewes is shown as solid bands above the graph.



- (i) During what time of the year did the oestrus normally occur?  
(ii) Suggest one advantage of this pattern of oestrus to the ewes in the control group.
- What does the experiment suggest about the regulation of the onset of oestrus in ewes?
- State what would happen if the barrier between fetal capillary and the wall of the villus was obliterated and replaced with a simple squamous tissue.
- Name the harmful substances and the property they possess that enable them to cross the placenta. (e) State other functions of the placenta to the fetus

(f) Explain the difference between the embryonic development in humans and amphibians **TURKISH LIGHT ACADEMY**

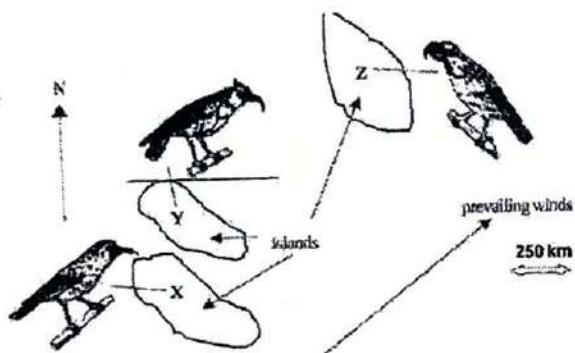
26. Figure below shows the heads of five species of finch inhabiting a volcanic oceanic island in the Galapagos group. The Galapagos islands lie about 600 miles from the South American mainland.



a) What major difference between the five species is shown in the figure and how might this difference be related to the habits of the finches?

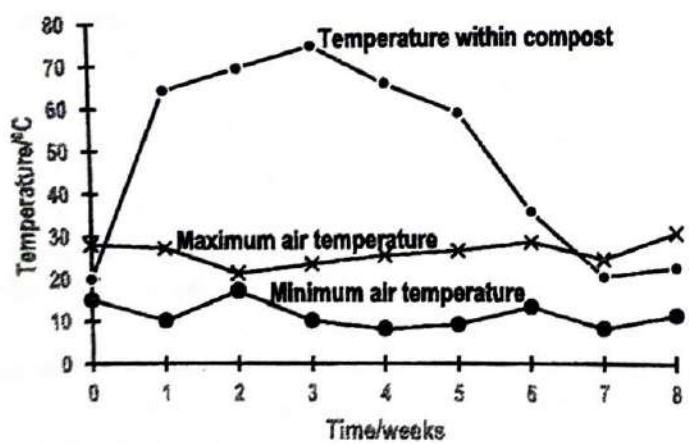
Darwin suggested that these finches probably descended from a common ancestral stock of finches. Explain how these ancestral finches may have reached the Galapagos islands.

- Explain how the modern diversity of finches arose from the ancestral stock.
- The different finch species on the island do not interbreed. Explain this observation.
- The plumage of the different finch species present is very similar. Suggest ways in which males and females of the same finch species may recognize each other.
- Three distinct populations of birds, X, Y and Z live on three isolated oceanic islands. The birds are all omnivorous, eating insects, tiny seeds and nectar, but have slightly different beaks and feather colourings. The islands are frequently swept by strong south-westerly gales. Populations X and Y can interbreed and form fertile offspring. Population Y can interbreed with population Z but the offspring are sterile. Population X will not even mate with population Z and artificial insemination of Z birds with X bird sperm is unsuccessful.



- Suggest an explanation why populations X and Y can still interbreed and form fertile offspring.
- Suggest an explanation why mating between Y and Z produces infertile offspring.
- Suggest an explanation for the inability of populations X and Z to mate. **OUR LADY OF AFRICA MUKONO**

27. Compost heaps have for long been used by farmers in recycling of nutrients. The figure below shows the variation of temperature within a compost heap, and air temperatures over an 8-weeks' time frame. Study it and answer the questions that follow.



- Compare the curves for temperature within the compost heap and maximum air temperature.
- Account for the trend in temperature within the compost heap over time of heap incubation
- Discuss the effects of heat generated by the rotting material.
- (i) How do fungi differ from plants?  
(ii) Suggest ways how the parasitic fungus *phytophthora infestans* suits its establishment.
- Explain:  
(i) ecological role of saprotrophism. (ii) economic importance of recycling in agriculture. **St. Mary's college Kisubi**

28. Figure 1 shows the energy continuum during time of exercise from its onset and figure 2 below shows the changes in relative tension in a skeletal muscle (sarcomere) as it contracts.

Figure 1

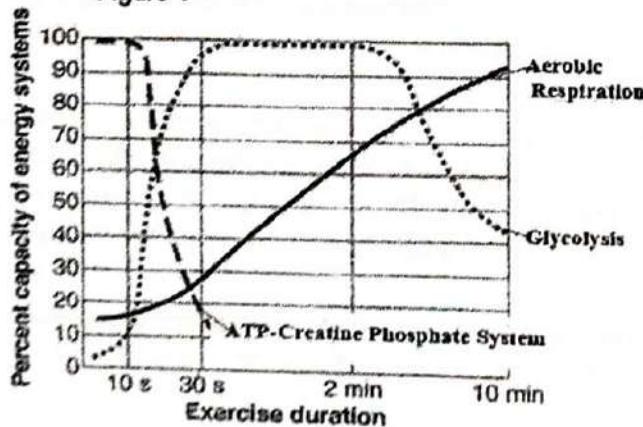
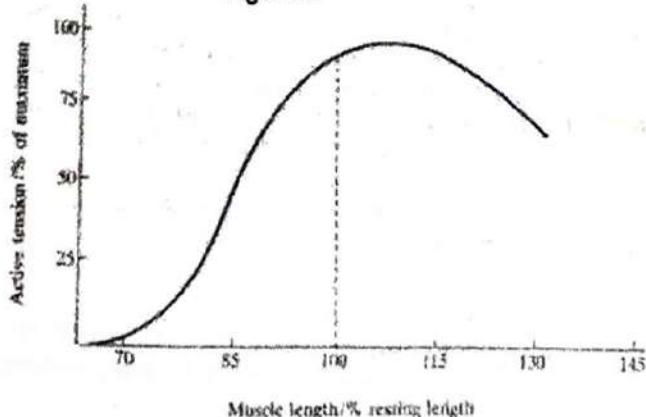


Figure 2



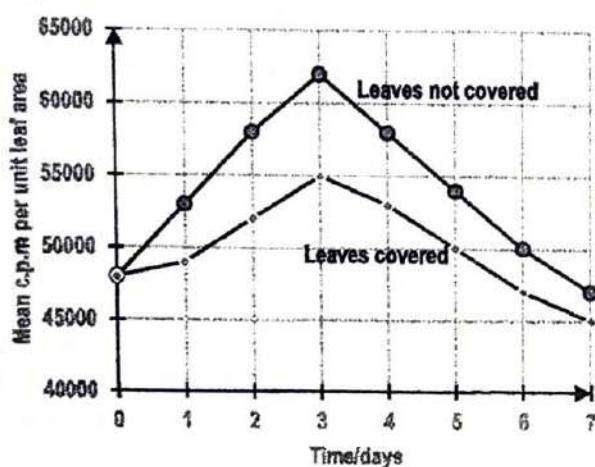
a) i) What conclusions can be drawn from the figure 1? ii) Account for the trend in energy use during the time of exercise as shown on the graph in figure 1.

b) i) Give an account of the changes in tension of skeletal muscle (sarcomere) in figure 2. ii) How are skeletal muscles suited for their function? **Kawanda ss**

29. a) (i) Explain why a double circulatory system enables mammals to have a high metabolic rate.

ii) Atropine is a drug that can be used to treat some forms of bradycardia leading to increase in heart rate. Explain how this result. b) (i) Describe how exercise leads to the stimulation of the cardiac centre in the medulla oblongata. (ii) State the changes that occur in a human being during diving. (c) Explain how atherosclerosis can cause coronary heart disease and eventually death. **RINES HIGH SCHOOL**

30. An experiment was carried out to investigate the movement of phosphate in bean plants. Twelve intact plants were placed for 24 hours with their roots immersed in a nutrient solution containing phosphate labelled with radioactive phosphorus ( $^{32}\text{P}$ ). The plants were then transferred to a non-radioactive nutrient solution. The leaves of six plants were covered with aluminium foil to exclude light. The mean radioactivity for the six plants in each group present in the leaves of all twelve plants was measured in terms of counts per minute (c.p.m) over a period of seven days. The results are shown in the figure below.



a) Compare the mean radioactivity for the two groups of plants.

b) Account for the difference in the mean radioactivity of the two groups of plants.

c) Briefly explain;

(i) The route taken by  $^{32}\text{P}$  from the nutrient solution to the leaves.

(ii) Why six plants were used for each treatment?

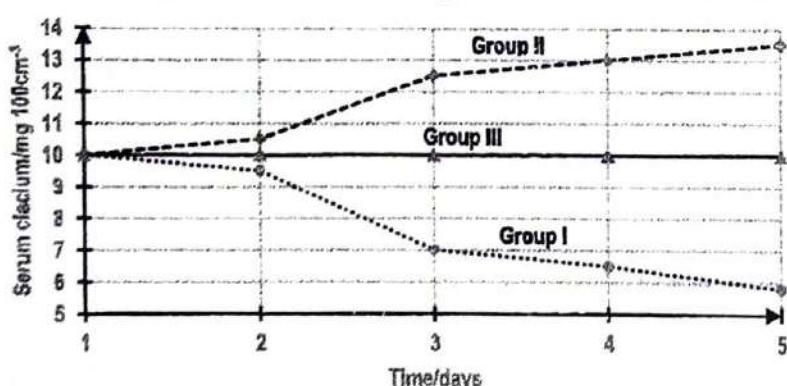
(iii) Why the amount of  $^{32}\text{P}$  continued to increase in the leaves even though the plants had been transferred to the non-radioactive solution?

d) What would the effect of;

(i) Exposing the plants to moving air on the amount of  $^{32}\text{P}$  accumulated in the leaves.

(ii) The darkening on the amount of starch and soluble sugars in the covered leaves. **OUR LADY OF AFRICA NAMILYANGO**

31. An experiment was carried out to investigate on the concentration of blood calcium using three different groups of people. Group I had hyperparathyroidism, Group II had their parathyroid gland surgically removed (parathyroidectomy) and Group III was the control whose parathyroid gland was functioning normally. The concentration of calcium ions in normal human blood serum ranges between 9 and 11 mg per  $100\text{cm}^3$ . The results of the experiment are shown in the figure below.



a) Compare the concentration of serum calcium for individuals in group I and II

b) account for the observed concentration of serum calcium in the three groups.

c) During the last two days of the experiment, individuals in group I experienced tetany. Briefly explain what is meant by the term tetany?

d) Suggest what can be done to the individuals in group I to overcome the situation experienced during the last two days of the experiment.

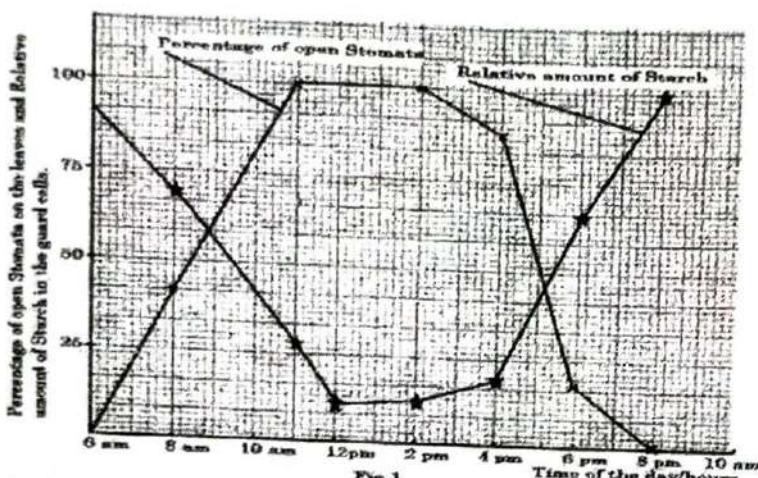
e) state how the serum calcium concentration would vary in an individual with a malfunctioning parathyroid gland.

f) Briefly explain why skeletal fractures and breaks are more likely in older women than in men of the same age? **BLESSED SACRAMENT SS KIMAANYA**

32. The figure below shows the results of an investigation on the effect of the relative amount of starch in the guard cells of the leaves on the percentage of open stomata on the leaf of C<sub>4</sub> plants.

a) Describe the relationship between percentage of open stomata and relative amount of starch.

- b) Explain the effect of each of the following on the percentage of the open stomata on the leaves.  
 i) Relative amount of starch in the guard cells (ii) Time of the day.



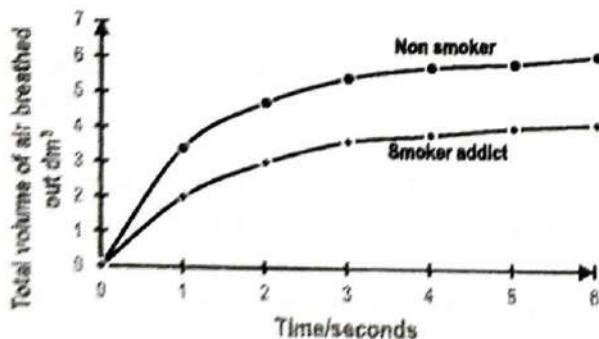
33. An Arabian camel, storing fat mainly in its hump weighs 400kg and lives in deserts where the temperature by day often 40°C. The fat in the camel's hump weighs 40kg and is a source of metabolic water. The table shows the day temperature, oxygen content and water content of desert air and air expired from the camel's lungs.

Type of air	Temperature (°C)	Oxygen content (cm <sup>3</sup> dm <sup>-3</sup> )	Water content (mgdm <sup>-3</sup> )
Desert air	40	200	5
Expired air	37	160	44

- During aerobic respiration 1 g fat requires 2 dm<sup>3</sup> oxygen and yields 1.07g water. In humans, fat distribution is different from that in camel. A 70kg human containing 14kg fat was considered.  
 a) calculate the mass of fat and volume of oxygen required by the camel to produce 321g of water.  
 b) describe the strategy used by the camel to ensure that most of the water in air expired from lungs is not lost to the environment.  
 c) compare the proportion and distribution of fat in the camel and the human. d) what is the significance of the differences in (c) above to each of the mammals in their habitat. e) The concentration of urine produced by a camel can twice that of a human. Suggest how the structure of the camel's kidney is adapted for producing such greater urine concentration. g) state the significance of ectothermic behaviour of camels.  
 f) Explain the significance of the variation of the; i) body size ii) body extremities between the temperate and desert mammals **SEETA HIGH SCHOOL GREEN CAMPUS**

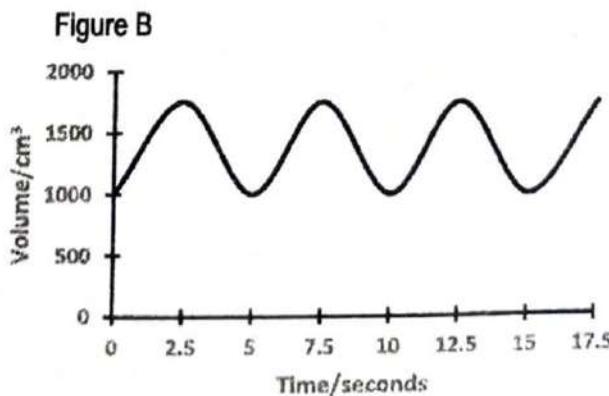
34. An investigation was carried out to determine variation in lung volumes and lung capacities under different conditions among individuals in a suburb of Kampala. Figure A compares the volume of air breathed out in non-smokers and the smoke addicts who have practiced the habit for over twenty years. Figure B shows the volume air in the lungs of a healthy individual at rest as recorded by a spirometer.

Figure A.

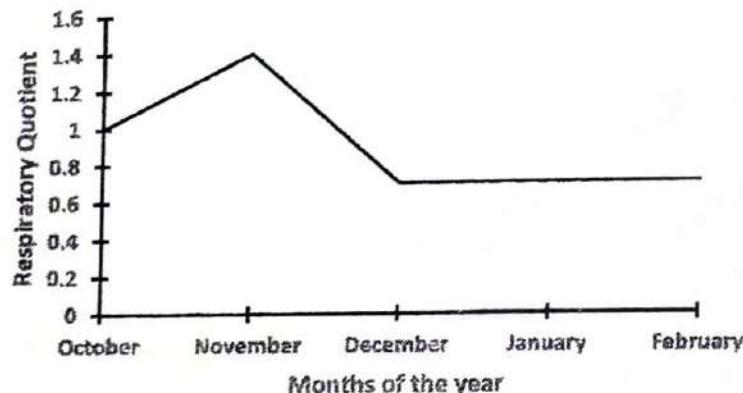


- a) From the spirometer trace given above, determine:(i) Breathing rate (ii) Tidal volume (iii) Pulmonary ventilation

- c) Describe events likely to occur when respiratory gases enter into mesophyll cells through open stomata.  
 d) Two adjacent guard cells were found to have a water potential of -1000pa, while the surrounding epidermal cells had a solute potential of -170pa and pressure potential of 1200pa.  
 i) Calculate the water potential on the stomatal apertures if osmosis occurred between the cells? Give a reason for your answer. LUWEERO SS

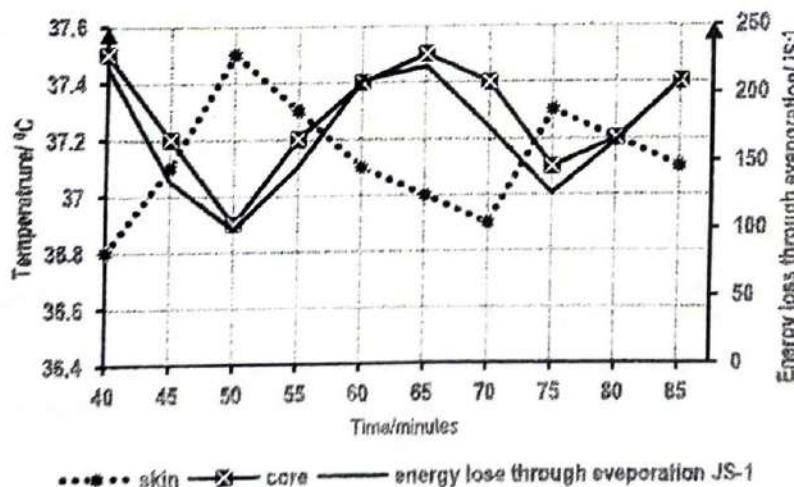


- b) Sketch a spirometer tracing that would be obtained if the individual got engaged in an exercise at  
 c) Explain the difference observed with onset of exercise  
 d) What effect would an increase in carbon dioxide concentration have on the ventilation rate?  
 e) Describe the physiological mechanism by which the effect is brought about and state its significance.  
 f) Describe how muscle action causes the changes in figure A  
 g) Explain the difference in volume of air breathed out between the smoker and non-smoker  
 h) An experiment was carried out to determine the respiratory quotient of a hedgehog during different seasons and the values obtained were represented on the figure below.



Autumn season (October to November) and winter season (November to February)  
 i) Account for the variation of respiratory quotient in autumn and winter  
 ii) State any two conditions in plants where RQ values similar to those in autumn can be obtained.  
 iii) State the importance of respiratory quotient values **BUDDO SS**

35. A special calorimeter was developed into which an adult nude male volunteer was kept initially at 45°C. Both surface and core temperatures rose initially but stabilised within 15 minutes. Forty minutes after entering the calorimeter, he was given a quantity of iced water to drink. This was repeated 30 minutes later. Measurements of surface temperature (skin) and core temperature, and of body heat lost due to evaporation were taken at five-minute intervals after the initial cold drink and the results were plotted on a graph as shown below.



- a) Describe the relationship between:  
 i) Core temperature and sweating  
 ii) Core temperature and energy loss through evaporation, between the two times of ice intake  
 b) Account for the relationship in a(ii) above  
 c) Explain how the initial rise in surface and core temperatures was stabilized  
 d) Explain the role of the following in temperature regulation:  
 e) Human skin (ii) Counter current heat exchange mechanism in the limb  
 f) Compare temperature regulation in plants and animals

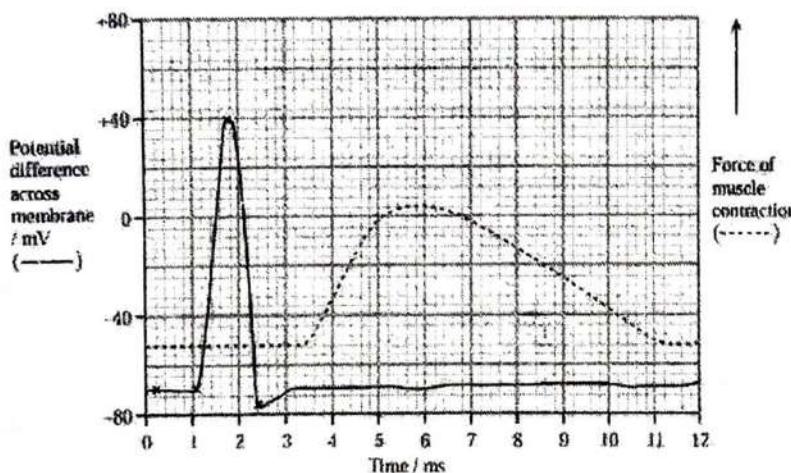
- g) Explain the importance of temperature regulation to an organism  
 f) Suggest why body temperature is regulated mainly by negative feedback and not positive feedback **KITENDE SS**  
 36. (a) State Mendel laws of inheritance and explain how meiosis illustrates these laws. b) Distinguish between complete linkage and incomplete linkage  
 (c) When two phenotypically wild type *Drosophila* with long wings and red eyes are crossed, two mutant phenotypes; curved wings and lozenge eyes are seen to segregate among the progeny as follows. Females: 600 long winged red eyed, 200 curved wings, red eyed. Males: 300 long winged lozenge eyed, 100 curved winged red eyed and 100 curved winged lozenge eyed. What is the genetic nature of; i) curved wing mutant (ii) Lozenge eye mutant (iii) Female parent (iv) Male parent.  
 (d) Using appropriate symbols, explain these results. (e) Describe the causes of deviation from Mendel's guidelines of inheritance **NAALYA SS BWEYOGERERE**

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

Wave length(nm)	Amount of light absorbed as a percentage of maximum		
	Red cone	Green cones	Blue cones
660	5	0	0
600	75	15	0
570	100	45	0
550	85	85	0
530	60	100	10
500	35	75	30
480	0	20	75
430	0	0	100
400	0	0	30

- a) From the data, explain why light of wave length:
- i) 430nm appears blue.      ii) 550nm appears yellow
  - iii) 570nm appears orange.
- b) Explain why two closely placed small objects can easily be distinguished by cones than rods.
- c) Compare the suitability of the mammalian eye and the compound eye in;
- i) light sensitivity.      ii) visual acuity.      iii) detecting flickering such as objects on a TV screen.
- d) i) Explain how an image is perceived by the human brain across a rod cell.      ii) Use the human eye to explain the term dark adaptation **SEETA HIGH SCHOOL MAIN CAMPUS**

38. In an investigation, an impulse was generated in a neurone using electrodes. During transmission along the neurone, an action potential was recorded at one point on the neurone. When the impulse reached the neuromuscular junction, it stimulated a muscle cell to contract. The force generated by the contraction was measured. The results are shown in the graph. The distance between the point on the neurone where the action potential was measured and the neuromuscular junction was exactly 18 mm.



- (i) On the curve for muscle contraction, identify the three phases shown
- (ii) Suggest explanation for the phases identified in (a) (i)
- (iii) Use the graph to estimate the time between the maximum depolarization and the start of contraction by the muscle cell.
- (iv) Use your answer to part (i) to calculate the speed of transmission along this neurone to the muscle cell. Give your answer in mm per second. Show your working.
- (v) Give one reason why the value

calculated in part (iii) would be an underestimate of the speed of transmission of an impulse along a neuron.

(b) Acetylcholine is the neurotransmitter at neuromuscular junctions.

(i) Describe how the release of acetylcholine into a neuromuscular junction causes the cell membrane of a muscle fibre to depolarize. (ii) Explain the effect of drugs on the synaptic transmission

(c) Use your knowledge of the processes occurring at a neuromuscular junction to explain each of the following.

(i) The cobra is a very poisonous snake. The molecular structure of cobra toxin is similar to the molecular structure of acetylcholine. The toxin permanently prevents muscle contraction.

(ii) The insecticide DFP combines with the active site of the enzyme acetylcholinesterase. The muscles stay contracted until the insecticide is lost from the neuromuscular junction. **KYADONDO SS**

39. After moving from bright light into darkness, it takes several minutes for the rod cells to recover their sensitivity.

Researchers measured the ability of the rod cells to detect small spots of light of different colours and intensity after a person moved into darkness. The results are shown in Figure 1. Figure 2 shows the amount of light of different wavelengths that rhodopsin absorbs.

(a) Explain why it takes time for the rod cells to recover their sensitivity to light after moving into darkness.

- ii) Use information in Figures 1 and 2 to explain the differences in sensitivity of rod cells to red and green light.  
 iii) Suggest an explanation for the difference in sensitivity of rod cells to the white and green spots after 30 minutes.

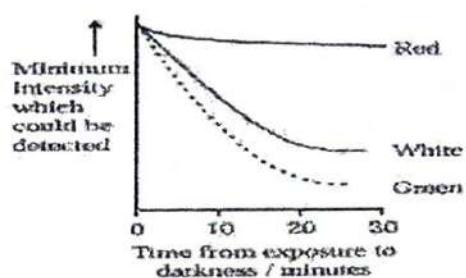


Figure 1

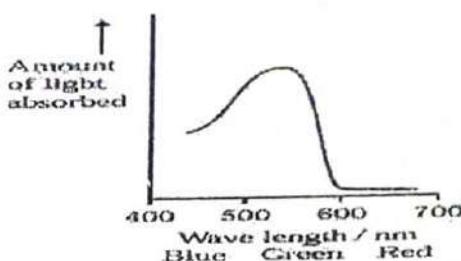
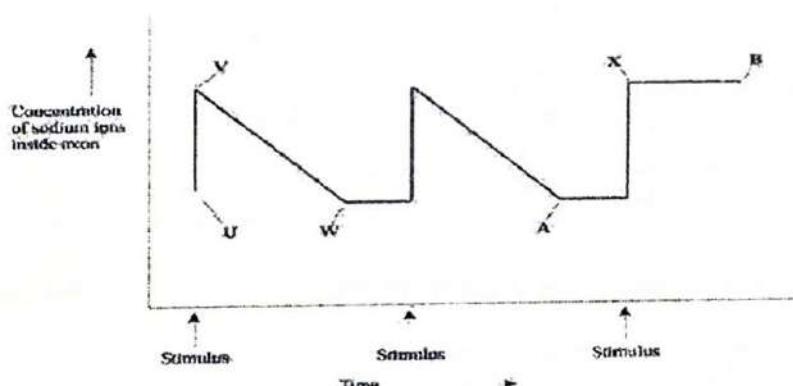


Figure 2

- b) The graph below shows changes in concentration of sodium ions inside the axon of a large neurone. The axon was stimulated at the points indicated on the graph. Between A and B on the graph the neurone was treated with dinitrophenol. This prevents the reduction of ATP



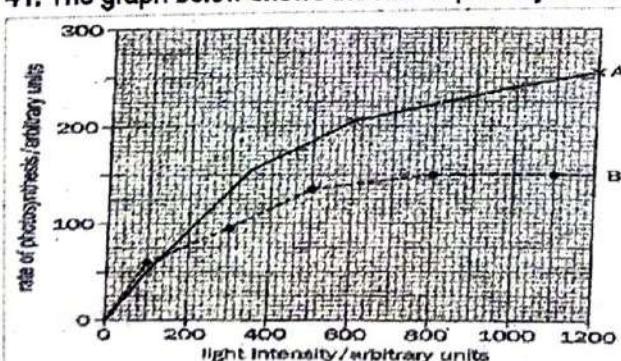
39. a) What does it mean by alternation of generation? b) Describe the significance of alternation of generation to the life cycle of plants. c) How are ferns better adapted to live on land than mosses? d) Outline the challenges land plants had to overcome in order to increase their independence from water. e) Explain the genetic significance of sporophyte generation being the dominant generation in flowering plants.

- f) State the distinguishing features of angiosperms. g) i) Describe how a gametophyte forms a sporophyte in a moss. ii) Explain why the fern species cannot survive entirely in dry environment. (iii) Briefly explain why the gametes produced by a mammal are genetically different while those produced by a fern are usually genetically identical. ST. BALIKUDDEMBE SS  
**MITALA MARIA**

40. (a) (i) What physiological features suit human parasites to their mode of life. (ii) Describe the life cycle of the common malaria parasite. b) (i) Explain why old antimalarial drugs such as quinine and chloroquine seem ineffective in treating malaria than they were before unlike novel drugs like artemisinin. (ii) Describe the biological factors that make malaria a difficult disease to control.

- c) Account for the fact that malaria-infested regions of the world are associated with a comparably high frequency of the sickle cell gene. **CORNERSTONE LEADERSHIP ACADEMY**

41. The graph below shows the rate of photosynthesis in two crop plants A and B at different light intensities.



- a) Describe the ways in which increasing the light intensity has; (i) Different effects on the two crops. (ii) Similar effects on the two crops.  
 (b) Suggest the most likely limiting factor for crop B at a light intensity of; (i) 100 arbitrary units. (ii) 1000 arbitrary units.  
 (c) Explain how C4 and CAM photosynthesis improve upon C3 photosynthesis.  
 (d) Describe the effects of light on abundance and morphology of plants. **MENGO SS.**

42. a) Explain how modifications of plant organs provide support. b) Describe the significance of secondary thickening in plants. (c) Describe the formation and function of; (i) lenticels. (ii) Annual rings  
 d) How does red light induce various processes of growth in particular plants?  
 e) State the functions of each of the following in the life cycle of an organism.

i) Cleidoic egg (ii) Coelom (iii) Bilateral symmetry (iv) Metameric segmentation PRIDE COLLEGE MPIGI

43.a) Describe the role of changes in PH in transport of respiratory gases.

b) Explain the physiological changes that may occur in humans under each of the following conditions; i) just before exercise. ii) during the race

c) i) With reference to the functioning of arteries, explain how blood flow to organs such as the kidneys is decreased during strenuous exercise.

Organ	Blood flow at rest/cm <sup>3</sup> min <sup>-1</sup>	Blood flow during strenuous exercise/cm <sup>3</sup> min <sup>-1</sup>
Skeletal muscles	1200	12500
Skin	500	1900
Kidneys	1100	600
Intestine	1400	600
Others	1600	1000
Total	5800	17500

- ii) Suggest explanations for the pattern of changes in the blood flow to the organs during strenuous exercise.  
 iii) The skeletal muscle respires much more rapidly during strenuous exercise. Explain how this results in oxyhaemoglobin unloading more oxygen to the tissue.  
 iv) What is the significance of red blood cells being impermeable to cations?  
**ST. JOSEPH NANSANA SS**

44. The diagram below shows the sequence of bases in one strand of the DNA from part of a gene. The base sequences are read from left to right.

A	C	C	C	C	A	T	T	T	C	A	T	C	C	A
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

The below shows the anti-codons of some tRNA molecules and the specific amino acids each would carry.

a) Using this information, write down the amino acid sequence coded for in this part of the gene.

The figure below shows same length of DNA after it has undergone a mutation.

Amino acid	tRNA Anti-codon
Alanine	CGA
Glycine	CCA
Lysine	UUU
Proline	GGA
Tryptophan	ACC
valine	CAC

a) Using this information, write down the amino acid sequence coded for in this part of the gene.

The figure below shows same length of DNA after it has undergone a mutation.

A	C	C	T	C	A	T	T	T	C	A	T	C	C	A
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

b) Describe how the polypeptide chain produced from this mutation may differ from the normal polypeptide.

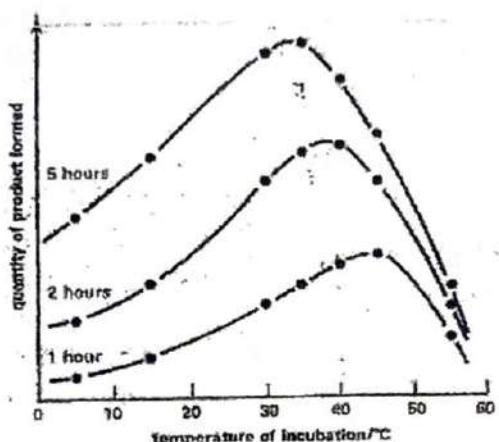
c) The sequence of bases shown below represents a short length of mRNA copied from a given DNA cistron. AUGGCCUCG AUCACGGCCACCAUGUAG. The amino acid Isoleucine is coded for by the following codons; AUU, AUC and AUA. What is the maximum number amino acids in the polypeptide for which this mRNA would code if it is; (i) non overlapping (ii) maximum overlapping

d) Write the; (i) DNA sequence from which the mRNA was transcribed (ii) Anticodon sequence for codons 3 and 9

e) Explain the effect of substituting the last nucleotide of the 4<sup>th</sup> codon with adenine on the nature of polypeptide formed from the above mRNA transcript when the code is; (i) Non overlapping (ii) Maximum overlapping. f) Explain why continuous and discontinuous DNA synthesis occurs in the 5' to 3' direction with respect to the newly formed strand. g) Describe the adaptations of tRNA molecule to its function. (h) State the importance of mutation.

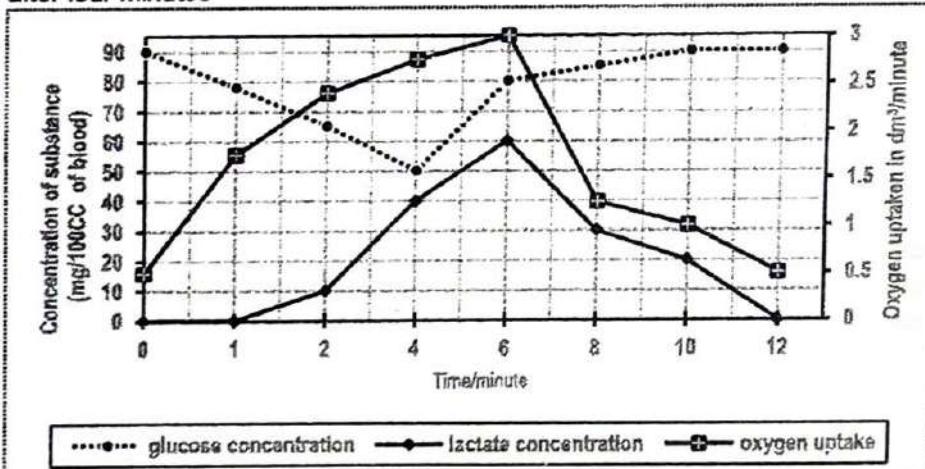
(i) Explain how mutation led to evolution of a new species by natural selection BULO PARENTS SS

45. The graph below illustrates the relationship between time, temperature and the amount of product formed in an enzyme-catalysed reaction. In the experiment, the samples were incubated at different temperatures for periods of 1, 2 and 5 hours. The quantities of products formed were then determined.



- (a) i) Describe the effect of increasing the incubation temperature on the quantity of product formed, as shown by any one of the curves presented in the graph above.  
 ii) Explain the effect of increasing the incubation temperature on the quantity of product formed described above.  
 (b) i) state the optimum temperature for the curves below.  
 1hour; 2 hours; 5 hours  
 ii) Explain why the optimum temperature is higher if the quantity of product formed is measured after 1 hour rather than after 5 hours.  
 c) Describe how the non-competitive inhibitors result into a reduction in the rate of reaction for an enzyme-controlled reaction. **BUSOGA COLLEGE MWIRI**

- 46.(a) Explain how a gene mutation can have; i) a positive effect on the individual. ii) no effect on the individual.  
 (b) Describe the significance of non-disjunction in sexual reproduction. **ST. HENRY'S MBALWA**  
 47. (a) Explain how; (i) the fovea enables an eagle to see its prey in detail. (ii) distribution and arrangement of photoreceptors of retina enables an owl to hunt its prey at night. (b) Give an account of the adaptation of receptors and the significance of this phenomenon **GREENLIGHT ISLAMIC NANSANA**  
 48. a) What is meant by the term oxygen debt. b) The graph below shows the variation in the glucose concentration, lactate concentration in blood and oxygen uptake with time of exercise of a normal non athletic individual. The exercise stopped after four minutes



Compare the variation in lactate concentration with; i) glucose concentration. ii) oxygen uptake. c) Describe the relationship between oxygen uptake and; i) lactate concentration. ii) glucose concentration. d) Account for the relationships described in (c) above e) (i)State and explain how the lactate concentration would vary if an endurance athlete was used.

- (ii) Explain why the concentration of creatine phosphate decreases immediately after the start of an exercise? **TRINITY COLLEGE NABBINGO**

49. a) What is the advantage of panting over sweating in temperature regulation.  
 b) Explain how panting result in the following conditions in the body of an organism; (i) alkalosis. (ii) increased heat production. c) Explain the effect of hyperventilation on an organism.  
 d) (i) Differentiate between the counter current multiplier effect and counter current heat exchanger.  
 (ii) Discuss the significance of the different counter current systems in organisms. **JINJA COLLEGE**  
 50.(a) what is meant by the term cavitation? (b)Describe the modification of Munch's theory of translocation.  
 (c) Describe stomatal movement basing on mineral ion change theory.  
 (d) What are the evidences to reflect that active movement of sugars within the sieve tube is based on the activity of the companion cells?  
 (e) Suggest a mechanism by which rise in abscisic acid concentration leads to closure of stomata. **ST. HENRY'S COLLEGE NAMUGONGO**  
 51.(a) What is meant by each of the following? (i) Polymorphism. (ii) Industrial melanism.  
 (b) Differentiate between transient and balanced polymorphism. (c) Outline the causes of polymorphism in a population.  
 (d) What is the role of polymorphism in evolution of organisms of a given a population? **VIENNA HIGH SCHOOL KABOWA**