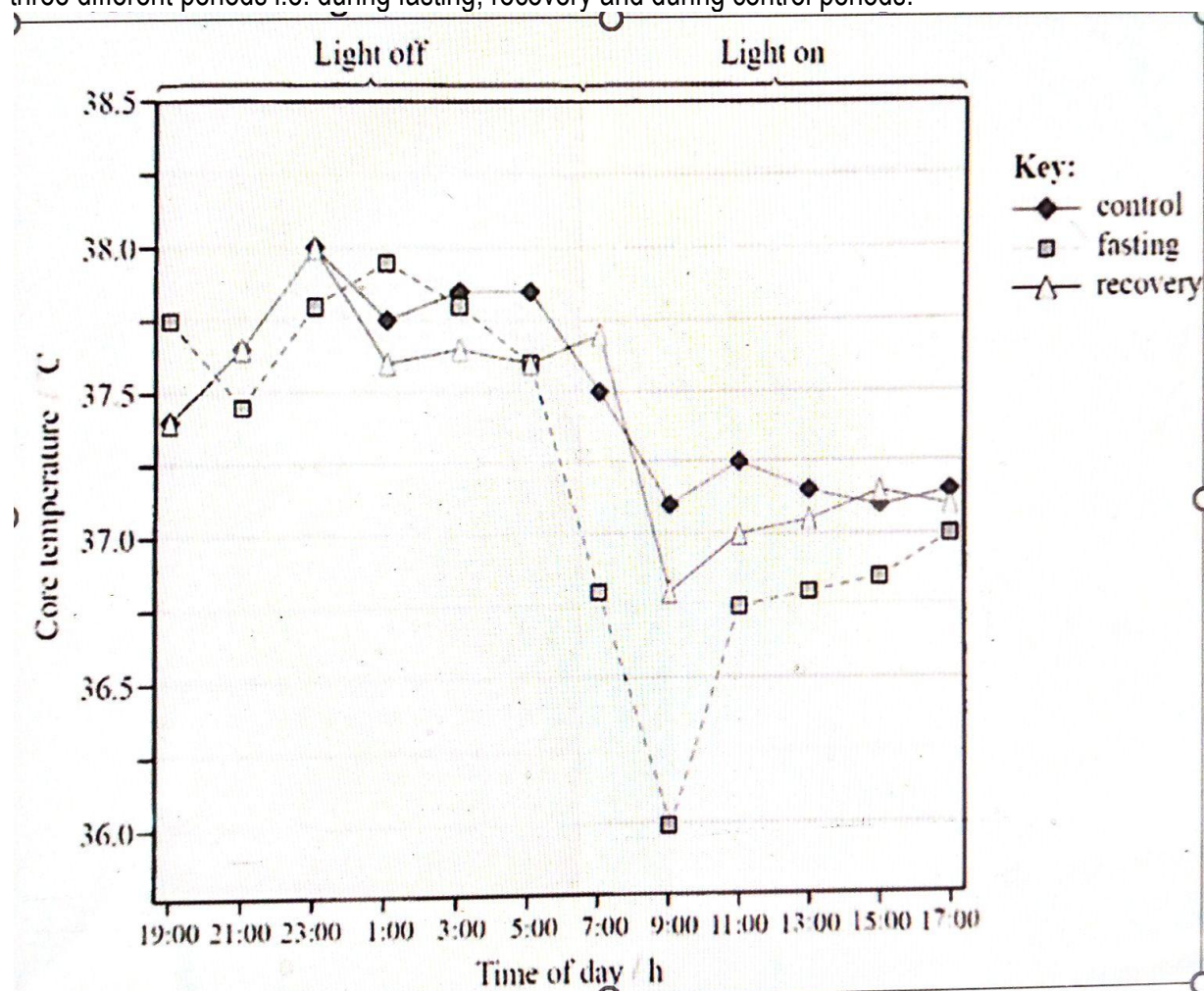


UMSS NAMUGONGO A' LEVEL BIOLOGY INTERACTIVE SEMINAR 2022

1) Figure below shows the variation of core temperature of rats with time when light was off and on, recorded during three different periods i.e. during fasting, recovery and during control periods.



- Identify the specific hour during the day with the highest core temperature of rats during the recovery period.
- Identify the lowest core temperature of rats during the control period
- Describe the variation of rat core temperature with time during the control period
- Compare the variation of core temperature during fasting and recovery periods
- Explain the difference in core temperature when the lights are on and off during the control period.
- Which attribute of a homeostatic system is being exhibited by the rat's thermal regulation during control period?
- State the possible mechanisms and structural features of rats that are responsible for the observed variations in core temperature between 7:00 and 17:00 hrs.

KINGS COLLEGE BUDO

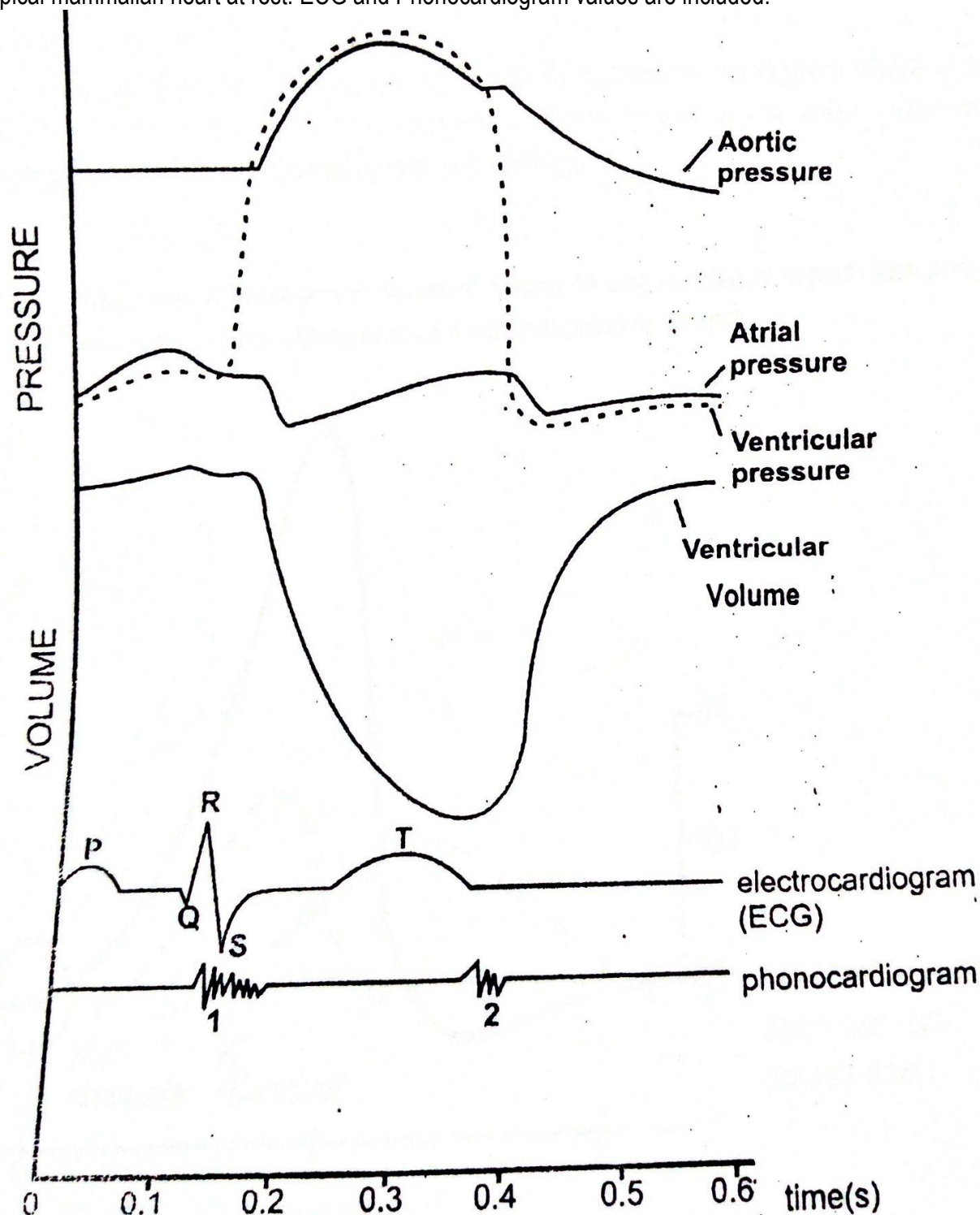
2. a) What is meant by each of the following?

- Genetic equilibrium
 - Genetic death
 - Genetic load
- Suggest reasons why populations in genetic equilibrium fail to evolve.
 - State instances where the evolution of one species has been influenced by the evolution of another.
 - Explain the importance of extinction in the evolution of new species.

MIDLAND HIGH

SCHOOL

3) The graph shows changes in the aortic Pressure, ventricular pressure, atrial pressure and ventricular volume of typical mammalian heart at rest. ECG and Phonocardiogram values are included.



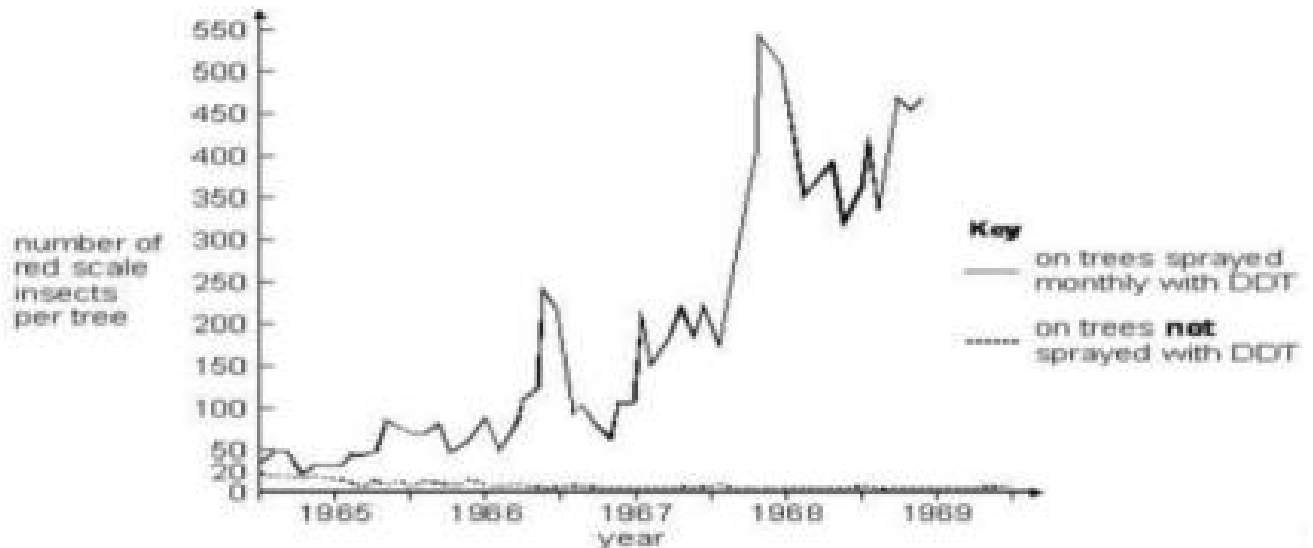
- Describe the changes in pressure within the atrium and ventricle for the first 0.5s
- Explain the significances of changes in aortic pressure, atrial pressure and ventricular pressure during the cycle.
- Refer to the phonocardiogram to mark off points that represent production of the first and second heart sounds.
- Describe the changes in the cardiac muscles that occur during their excitation that lead to the following signals on ECG;

P wave	QRS complex	T wave
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v) With reference to their properties and structure, state adaptations of cardiac muscles to their function.

ST. JOSEPH'S S.S NSAMBYA

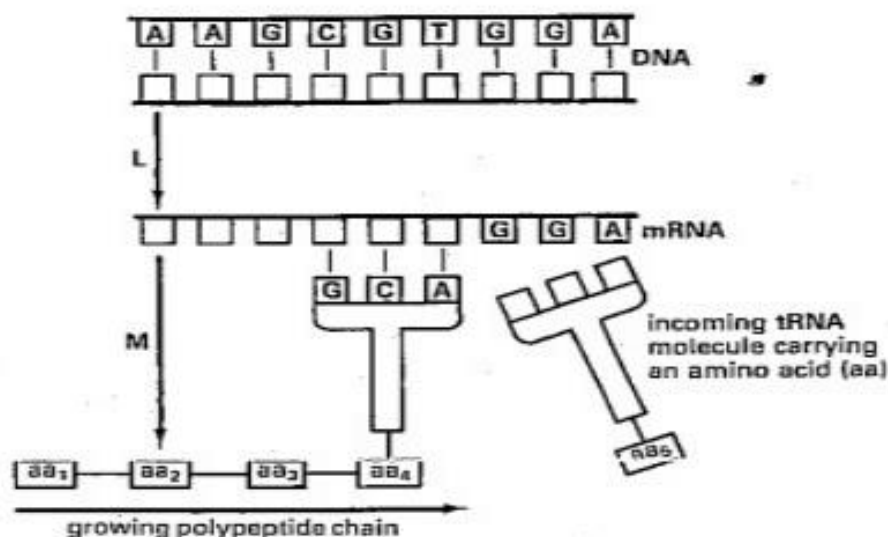
4) The graph below shows populations of the red scale insect pests on trees sprayed with chemical DDT and untreated(unsprayed) trees over the course of time.



- Describe the trend of population change of pests on treated and untreated trees
 - Account for the changes in populations of pests on treated and untreated trees
 - Pesticides are known to cause occurrence of pesticide resistant strains of pests in population. Explain any other properties of DDT other than the one stated above that render it unsuitable for use in environment.
 - Discuss other alternative methods for control of pest population.
- Where possible sketch graphs depicting likely pest population changes with time of application of such methods.

UMSS NAMUGONGO

5) The diagram shows information flow in protein synthesis

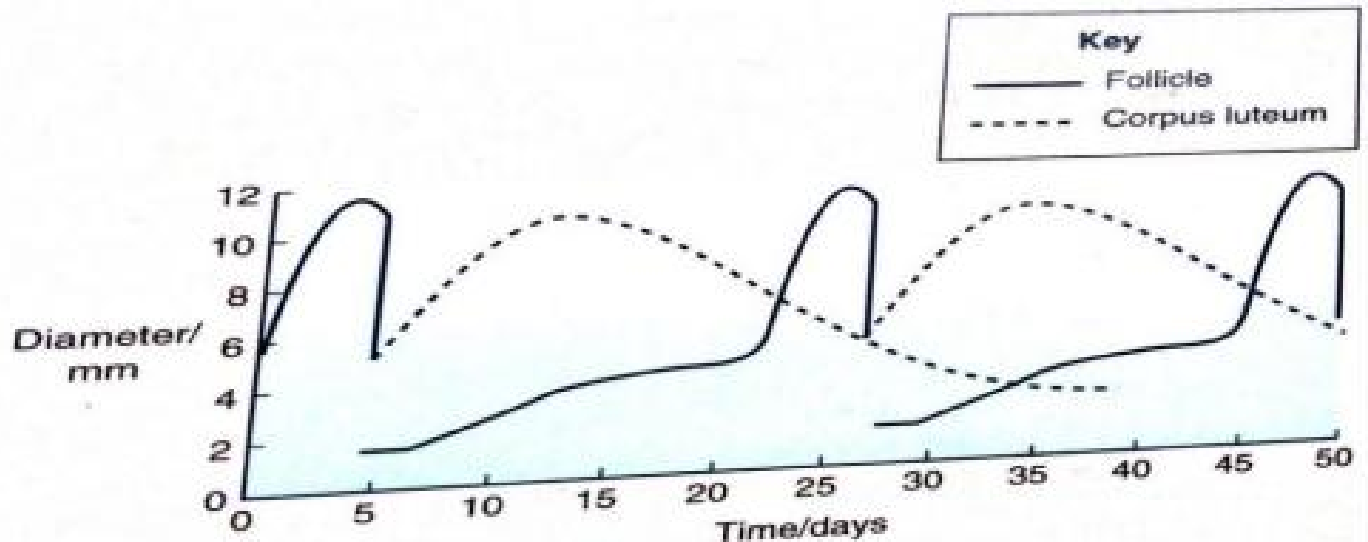


- write in the boxes the missing initial letters of bases on DNA and mRNA strand
- Fill in the bases on tRNA anticodon
- Briefly compare structure and function of mRNA and tRNA
- Name the processes labelled by L and M, state where they take place in a cell
- Suggest explanations for the following;
; DNA is not transcribed in cytoplasm

- Nucleus is centrally located in a cell
 - Compartmentalization in eukaryotic cells
- vi) List structural features of DNA that contribute to its stability.

ST. HENRY'S COLLEGE KITOVU

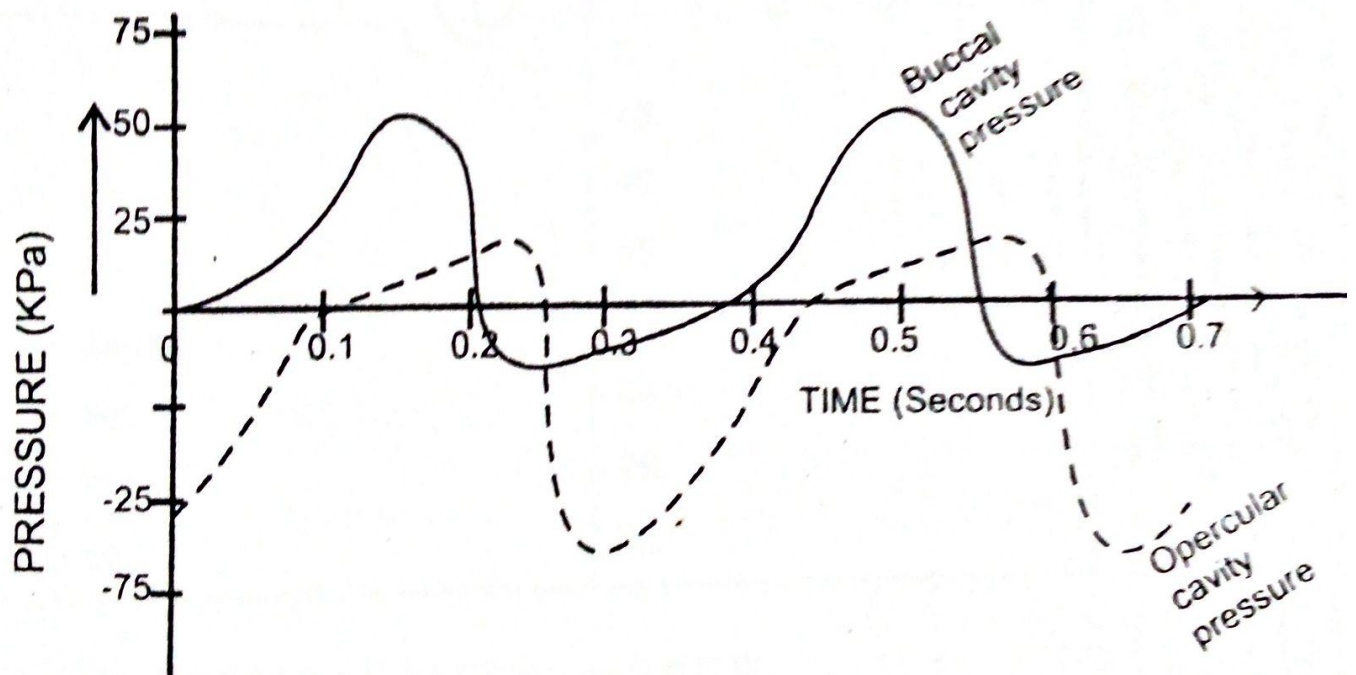
5) The graph shows changes in the mean diameter of follicles and *corpora lutea* in the ovaries of a pig over a period of 50 days.



- Explain the changes in follicle size which took place between day 5 and day 27.
- Describe the part played by hormones in producing these changes.
- Describe two pieces of evidence which suggest that this animal did not become pregnant over the period of time shown on the graph.
- Mark the graph with an arrow to show one time when you would expect this animal to be in oestrus.
- Explain why hormones progesterone and oestrogen are used in synthetic pills.

BISHOP CYPRIAN KIHANGIRE SSS

6) The graph shows pressure changes in the buccal and opercular cavities of teleost fish.



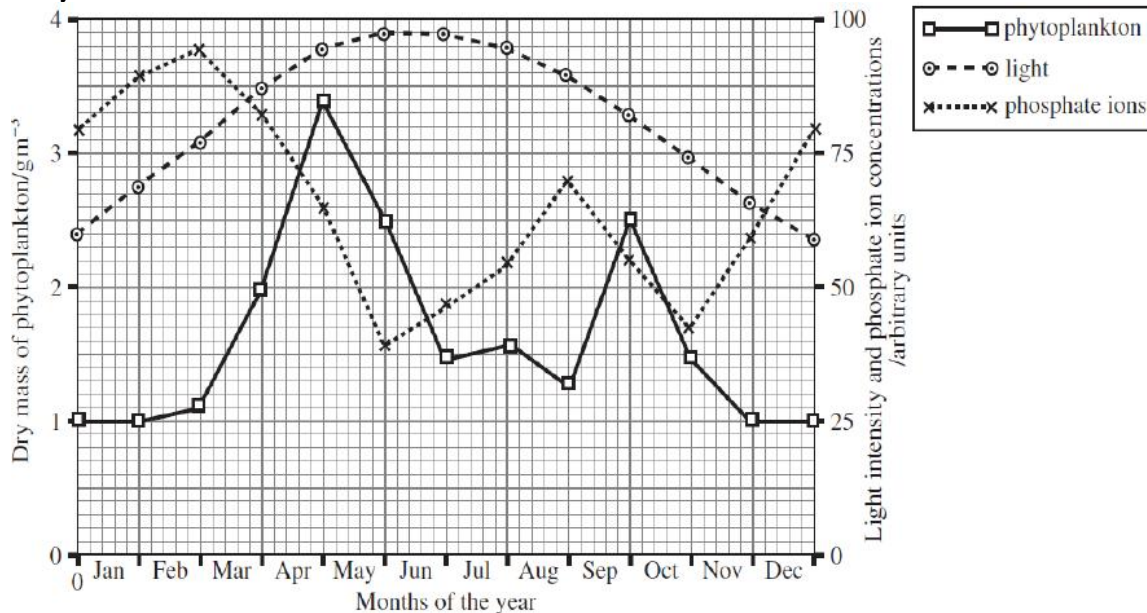
- Explain how the positive and negative pressure changes lead to exchange of gases along gill filaments.
- Give reasons for the following

- Air is relatively better respiratory media than water
- Higher animals with blood circulation systems evolved respiratory pigments
- Respiratory system of insects limits their size

iii) Give reasons why mechanism of gaseous exchange above is more efficient than that exhibited by cartilaginous fish.

ST. JOHN'S S.S MPIGI

7) The graph shows the abundance of phytoplankton together with amounts of light and phosphate ions throughout one year in the surface waters of a lake.



- Comment on the relationship between dry mass of phytoplankton with; light intensity over the year; phosphate ion concentration over the year
- Describe and suggest an explanation for the changes in the phytoplankton population during the months of May and September.
- The zooplankton populations peak twice during the year. During which months are these peaks most likely to occur? Explain your choice.
- What could have been the possible sources of phosphate enrichment in the lake?
- Discuss factors that influence distribution and abundance of variety of the life forms in aquatic ecosystems.

SMACK

8. a) Define heterosis.

b) *Spartina maritima* is a grass species with 56 chromosomes while *spartina alterniflora* has 70 chromosomes. The two grass species can be crossed to produce hybrids.

i) What will be the chromosome number of the hybrids? ii) Explain what would happen if the hybrids are crossed.

c) If the hybrids undergo polyploidy, tetraploids are formed, what will be the chromosome number of the tetraploid?

li) Suggest possible survival advantages of the tetraploid grass.

d) i) Explain how polyploidy results in variation.

ii) Why is polyploidy rare in animals?

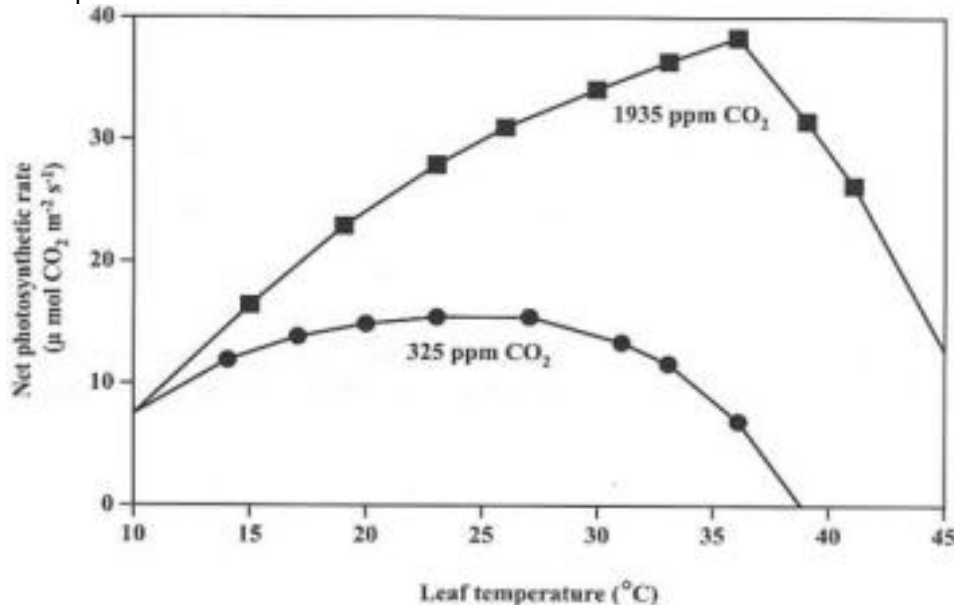
TURKISH LIGHT ACADEMY

9. a) Define leaf area index and state its significance.

b) Distinguish between compensation point and compensation period.

- c) How does photorespiration account for the known effects of carbon dioxide and oxygen concentration on the rate of photosynthesis in C₃ plants?
- d) i) Describe the photosynthetic mechanism which occurs in the cytoplasm of the mesophyll cells of C₄ plants.
 ii) Explain the physiological significance of the mechanism described in d(i) above
- e) State the differences between bundle sheath and mesophyll chloroplasts in a typical C₄ plant. **NDEJJE S.S.**

10. The graph shows net photosynthetic rates at different temperatures of the leaves exposed to concentrations of atmospheric carbon dioxide.



- i) Describe the effect of leaf temperature on the net photosynthetic rate at 1935 ppm CO₂.
- ii) Using leaf temperature, explain the effect of CO₂ increase on the rate of photosynthesis. iii) Drawing conclusions from the results above, how can farmers increase crop yield in green houses?

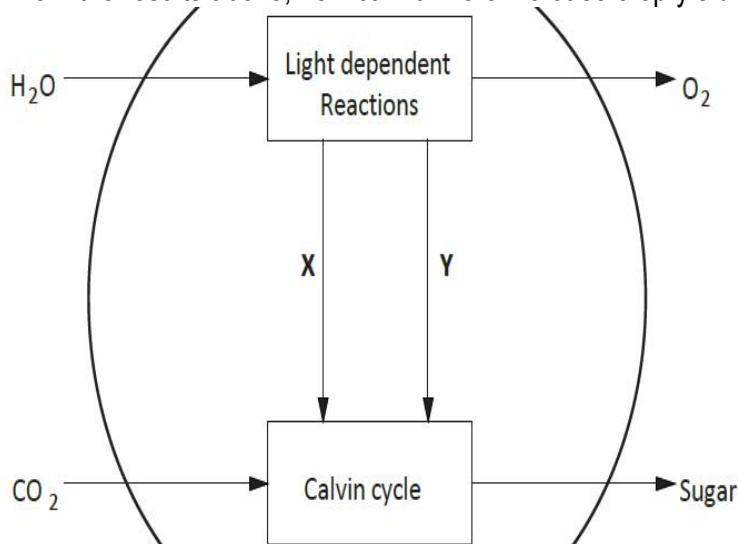
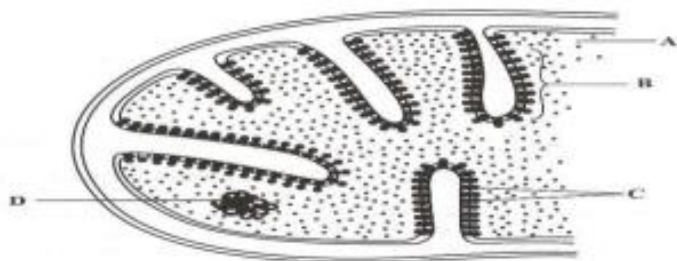


Figure besides shows the relationship between the light dependent and light independent reactions in a chloroplast.

- i) Name substances **X** and **Y** in Figure above.
- ii) Describe the steps involved in the formation of the products in the above reactions.
- iv) Explain what makes C₄ plants more photosynthetically efficient than C₃ plants. **ST JULIAN SS GAYAZA**

- 11) i) What is feedback regulation?
- ii) Explain with aid of annotated diagrams where possible and with reference to type of feedback, how feedback mechanisms lead to the following;

- Reduction of blood pressure when a person loses substantial amount of blood
 - Control of body metabolism after the high critical temperature
 - ADP/ATP ratio affecting progress of glycolysis in cytoplasm.
- ii) Discuss the hormonal regulation of the following processes in plants



12) a) Figure below is a diagram of the structure of part of a mitochondrion as seen in longitudinal section.

i) Define the term phosphorylation

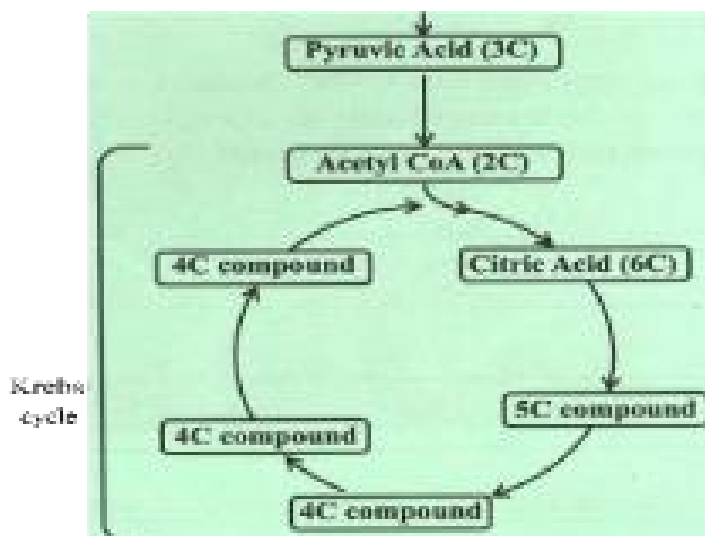
ii) Identify the structures labelled A, B, C and D in the above figure.

iii) Describe the role of the reactions that occur in the part labelled B in cellular respiration.

iv) Distinguish between photophosphorylation and

oxidative phosphorylation.

b) The figure below is a simplified diagram of the Krebs cycle and the preceding reactions.



i) Briefly explain the role of NAD in the Krebs cycle, in relation to energy production.

ii) Briefly explain how the rate of respiration is controlled in an organism.

Explain;

iii) What would happen to the step of respiration that occurs in the cytoplasm if NAD is not regenerated.

iv) The effect of introducing cyanide in the mitochondria on the rate of energy production.

KIBULI S.S.

13) a) Explain how long necked giraffes evolved according to:

;Lamarck

;Darwin

b) Discuss the main features of Neo-Darwinism

c) Suggest explanations for the following:

i) Absence of an effective vaccine to give long term protection against plasmodia species that cause malaria.

ii) Incompleteness of the fossil record.

iii) High prevalence of sickle cell anaemia in the sub-Saharan Africa.

iv) Development of industrial melanism in peppered moths in Great Britain in the mid-1800s.

v) Colour blind individuals in populations are much more than hemophiliacs. **MAKERERE COLLEGE SCHOOL**

14. a) Define the following terms

i) Conservation

ii) Endangered species

iii) Greenhouse effect

b) State techniques used to conserve natural resources

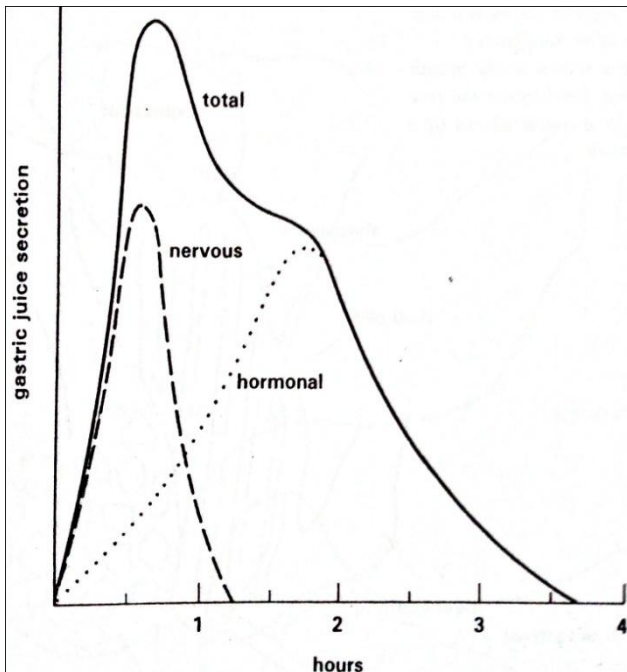
c) Give reasons why greenhouse effect has become a global concern.

d) Mention ways how greenhouse effect can be reduced.

e) How do each of the following human activities harm the environment

i) Use of plastics

15) The figure below shows the relative influence of nervous (vagus) and hormonal (gastrin) stimulations on the secretion of gastric juice



ii) Use of chlorofluorocarbons

i) Describe the effects of nervous and hormonal stimulations on gastric juice secretions

ii) Explain the relative importance of nervous and hormonal stimulations on gastric juice secretion as described above

iii) Discuss the composition and function of gastric juice components

iv) Draw conclusions from the graph above and suggest why gastric juice is secreted before food even enters the stomach.

MT. ST. HENRY'S MUKONO

16. The table below compares the features of the two North American reindeer (*Ranifer tarandus*) subspecies. An ice sheet of last ice age separated the southern and northern populations of *R. tarandus*.

Feature	Woodland subspecies <i>R. tarandus caribou</i>	Barren ground subspecies <i>R. tarandus groenlandicus</i>
Habitat	Southern woodland (warmer)	Northern tundra (colder)
Type of food	Tree, leaves, grass	Lichen, moss
Summer and winter-feeding grounds overlap	Yes	No
Carry out long migrations	No	Yes
Body size	Large	Small
Colour of fur	Dark	Light

i) Define the term speciation.

ii) Explain how this ice sheet affected the evolution of *R. tarandus* to result in the two different subspecies.

iii) Explain how natural selection and genetic drift can lead to:

- Different colors of fur of the two subspecies of reindeer.
- The different body sizes of the two subspecies of reindeer.

iv) Hybridization has occurred between individuals of the two subspecies that now live in the area previously covered by the ice sheet. Comment on how the hybrid populations compare to the pure subspecies in terms of genetic variation and potential to adapt to the climate change.

BUDO S.S.

16.a) Compare the structure of skeletal and cardiac muscles.

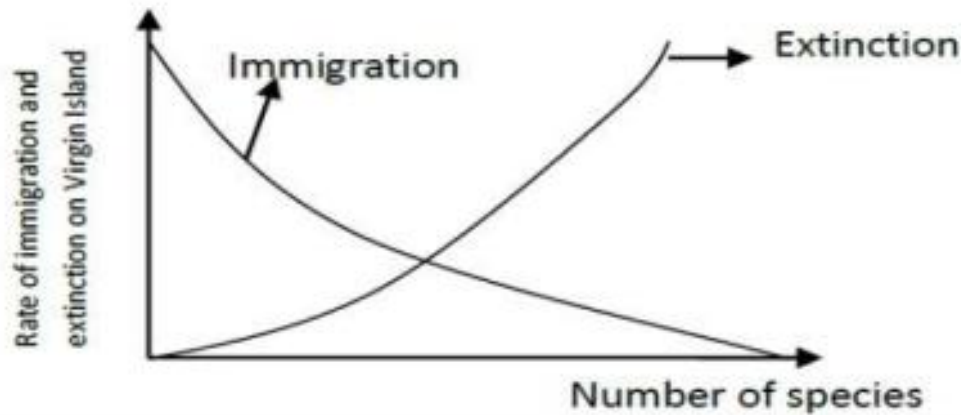
b) How can special features of contraction of the cardiac muscle be related to its function and physiology?

c) Explain why cardiac muscles normally contract for life under fatigue even under strenuous exercise.

d) Describe the sliding filament theory of muscle contraction with reference to the micro-anatomy of a skeletal muscle.

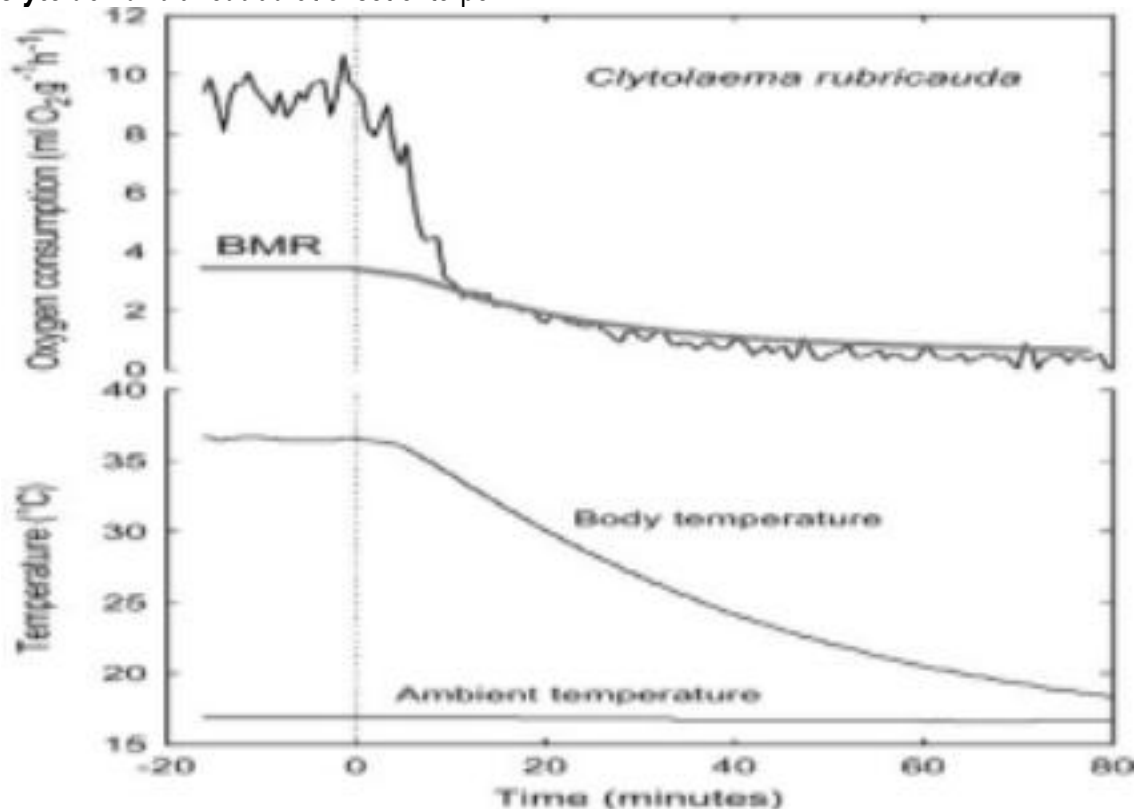
SEETA HIGH GREEN CAMPUS

17. The figure shows the rate of immigration and extinction of species on a virgin island.



- Explain the relationship between the measurable variables on a virgin island.
- From the graph, suggest factors that could determine the number of species on the island.
- State the factors that may affect the immigration of new species to the island.
- Under what circumstances may different species co-exist freely on a very small island?
 - Use natural selection to explain the competition exclusion principle. **KITANTE HILL S.S.**

18. The graph below shows changes in oxygen consumption, body temperature and BMR of humming bird *Clytolaema rubricauda* at onset of torpor.

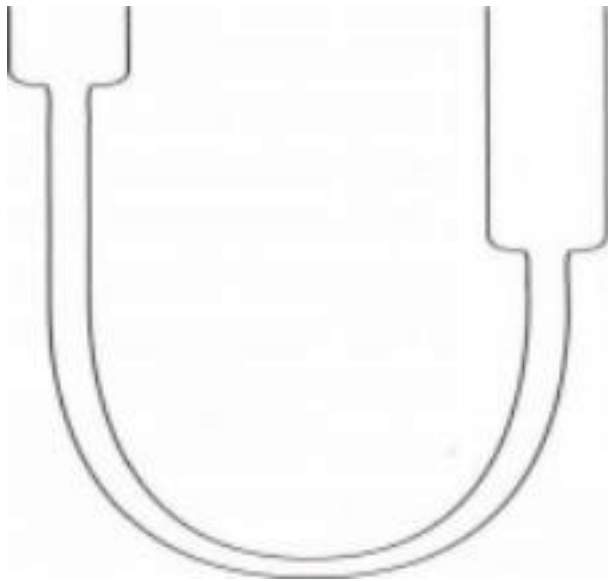


- Describe the variation of BMR with body temperature and oxygen consumption
- Explain variation of BMR with body temperature and oxygen consumption at onset of torpor
- State any other parameter(s) apart from BMR that can be used to measure metabolic rate and how it (they) would vary in animals preparing for hibernation or torpor. Use graphs to illustrate where possible.

iv) Explain other factors that affect BMR.

NAMIREMBE HILLSIDE SCHOOL

19. Figure below is a diagrammatic representation of the loop of Henlé of a nephron.



Using arrows labelled A, B, and C, indicate on Figure where;

A — water leaves the loop of Henlé by osmosis

B — sodium ions and chloride ions leave the loop of Henlé by diffusion

C — sodium ions and chloride ions leave the loop of Henle by active transport.

i) Account for the numerous mitochondria in cells of the region of the loop of Henlé labelled C.

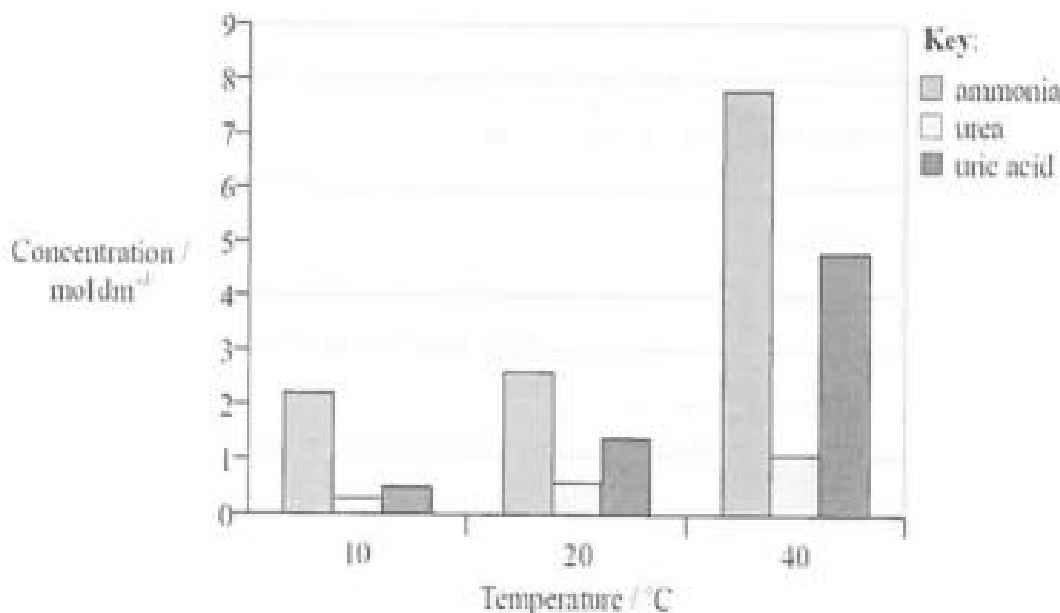
ii) How does the concentration of urine of small desert mammals differ from that of small typical tropical forest mammals? Suggest the structural modifications of the loop of Henle that may be responsible for this difference.

iii) Protein and glucose were found to be present in a sample of human urine. Identify the regions of the nephron which may not

have been functioning. Explain how this effect is dangerous to the body of the organism.

iv) The proximal convoluted tubule is responsible for the process of selective reabsorption. With reference to its structural features, discuss how it is suited to this function. **NAALYA SS NAMUGONGO**

20. The graph shows concentrations of nitrogenous waste products from urine collected from Humming birds at three different external temperatures.



i) Calculate the ratio of the concentration of ammonia to that of uric acid at 40°C and draw a conclusion.

ii) State why the investigator collected urine samples at three different temperatures

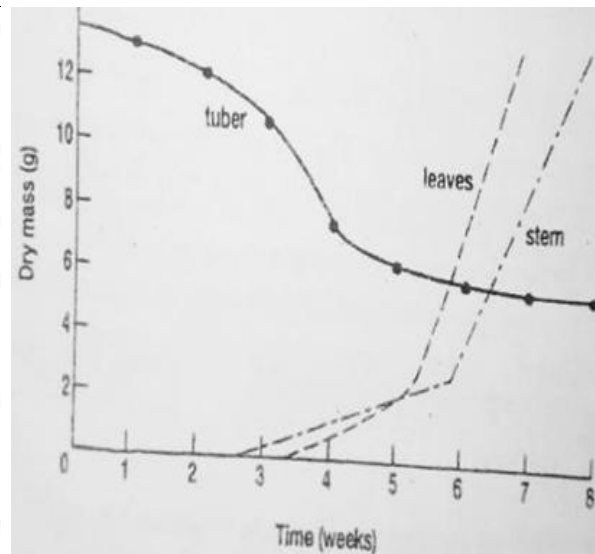
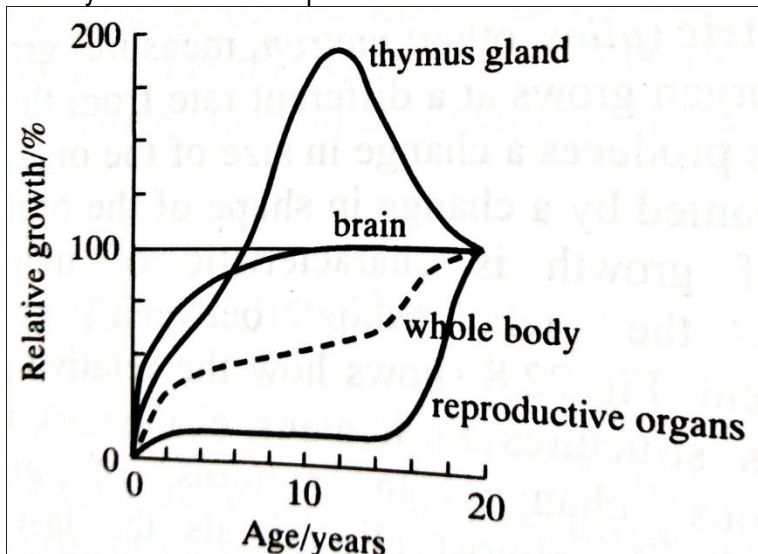
iii) Explain the difference between the concentration of nitrogenous wastes produced at 20°C and 40°C.

iv) Basing on the data provided, state the mostly likely challenges hummingbirds face.

- v) State which waste has the greatest change in concentration between 10°C and 40°C
- vi) with a reason, state the chemical of life that is abundant in the diet of hummingbirds
- vii) state the benefits hummingbirds would have if they had uric acid concentration greater than ammonia concentration in their urine.

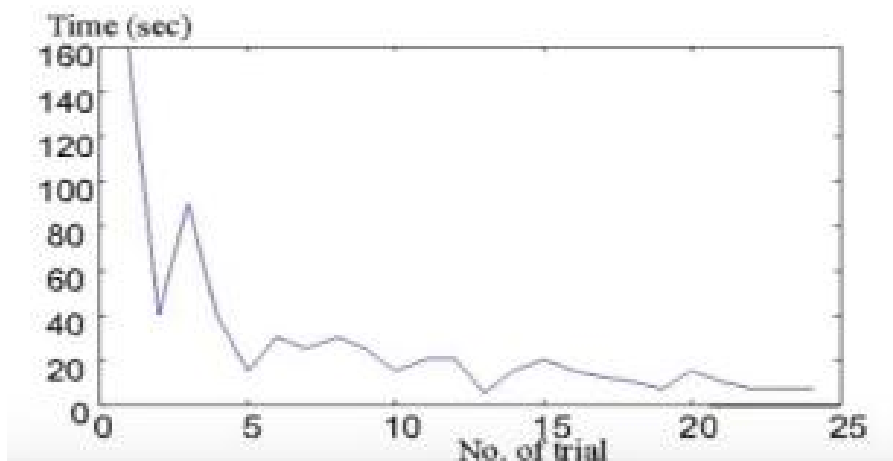
NAMILYANGO COLLEGE

21. The graphs below show growth curves for potato plant grown from a tuber(A) and human beings(B), study them critically and answer the questions below.



- Name the types of growth exhibited by the two organisms; provide reason for your answers.
- With appropriate description, explain the shape of the curve B.
- Discuss the phase(s) of growth for the stem of a potato plant
- If the ratio of brain size to body size is 1:24 in an adult human being, estimate from the graph the ratio in a 10-year-old.
- "Whilst growth and differentiation may be influenced by hormones, metamorphosis is almost entirely controlled by **endocrine secretions**". Discuss briefly how endocrine secretions influence metamorphosis in insects. Talk about influence of external cues where possible. **ST HENRY'S S.S. MBALWA**

22. Edward Thorndike placed a cat in a puzzle box, it was rewarded with food and freedom every time it escaped (solving the puzzle). The time taken for the cat to escape was recorded. The experiment was repeated several times with the same cat.



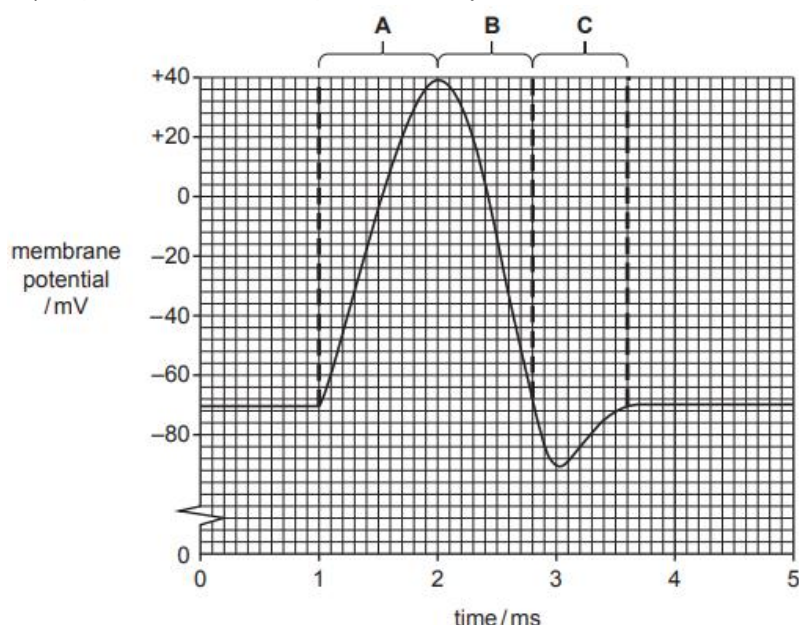
- Account for the changes in time spent by cat in box at different trial numbers.
- What evidence shown by the figure shows that learning took place?
- State three factors that could affect the learning of a new situation like a puzzle box in animals.
- How could the time needed by the cat to escape out of the puzzle box be reduced?
- Discuss the characteristics of reflexes.

GOD'S HOPE NAKASEKE

23. The table below shows the axon diameter and the mean impulse transmission speed of four different types of mammalian neuron.

Neuron type	Myelination	Mean axon diameter μm	Mean impulse transmission speed / ms^{-1}
Motor α	+	13.0-20.0	80-100
Motor β	+	6.0-12.0	35-75
Motor σ	+	1.0-5.0	5-35
Motor C	-	0.2-1.5	0.5-2.0

i) Explain the relationship between Myelination, Axon diameter and mean impulse transmission speed.



The figure below is a graph of an action potential in a mammalian neuron

i) Explain the shape of the graph using regions A, B and C.

ii) Suggest why it is difficult for a further action potential to occur during C.

iv) From the above, and using properties of cardiac muscles, why do they normally function for life without fatigue.

MBOGO COLLEGE SCHOOL

24. a) What is meant by after-ripening and state its significance?

b) Two sets of seeds; dormant seeds and non-dormant seeds were soaked for 24 hours. After this period, investigations were conducted to determine the oxygen intake by the seeds. Results are shown in the figure.

i) Describe the trend of oxygen intake in the two sets of seeds.

ii) Suggest reasons for the initial increase in oxygen intake by both sets of seeds after 10 hours.

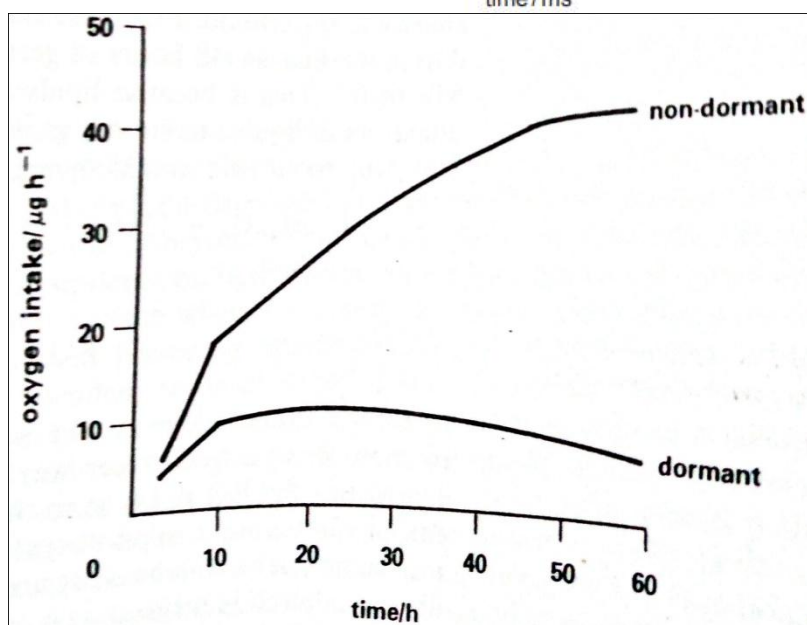
iii) Explain the difference in the trend of oxygen intake in the two sets of seeds after 10 hours.

iv) Give ways how viable seeds utilize absorbed water

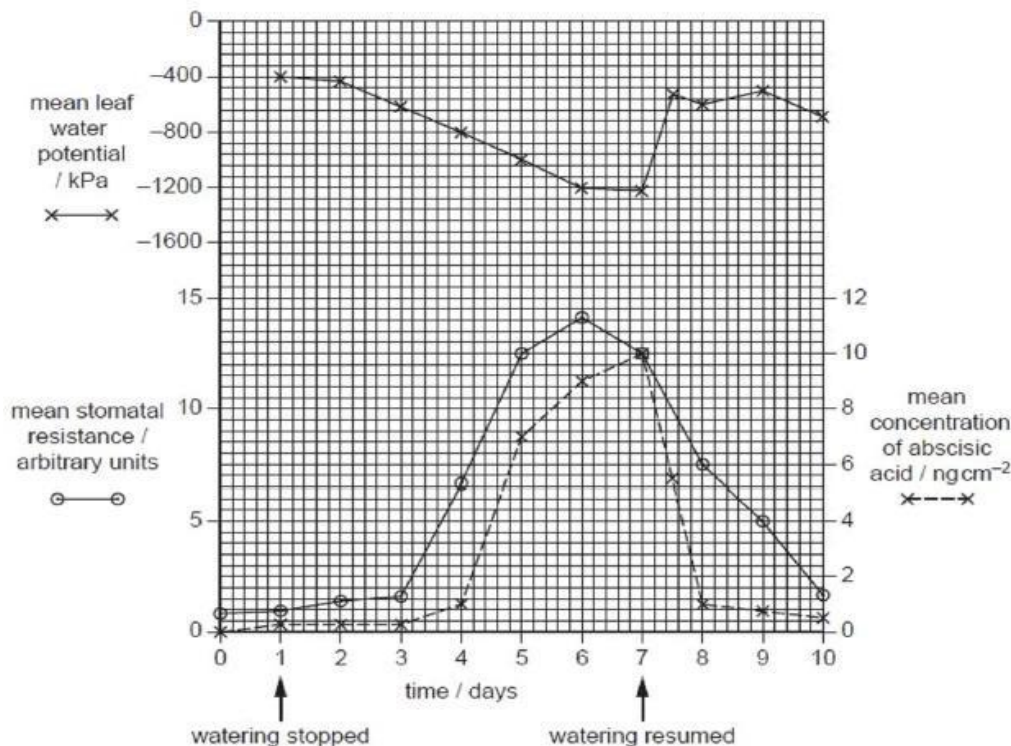
c) State the advantages of seed dormancy.

SEROMA CHRISTIAN HIGH SCHOOL

25. The graph shows values of water potential, abscisic acid concentration and stomatal



resistance of sorghum leaves over a given period. The sorghum plants were kept in the same water, temperature and light conditions but water supply was varied.



- Briefly discuss stomatal resistance and leaf area index.
- What effect would extreme intensities of light and temperature have on the experimental results from the start of the experiment?
- Describe and explain the changes in concentration of abscisic acid and stomatal resistance with time.
- Discuss the would-be ecological significance of changes described above especially to sorghum if it is planted in arid areas.
- Discuss how increase in stomatal resistance can affect photosynthetic efficiency of sorghum. **SCHISK**

27. a) Define leaf area index and state its significance.

b) Distinguish between compensation point and compensation period.

c) How does photorespiration account for the known effects of carbon dioxide and oxygen concentration on the rate of photosynthesis in C3 plants?

d) i) Describe the photosynthetic mechanism which occurs in the cytoplasm of the mesophyll cells of c4 plants.

ii) Explain the physiological significance of the mechanism described in d(i) above

e) State the differences between bundle sheath and mesophyll chloroplasts in a typical C4 plant.

28. a) Explain how modifications of plant organs provide support.

b) Describe the formation of lenticels in dicots.

c) Discuss the significance secondary thickening in plants.

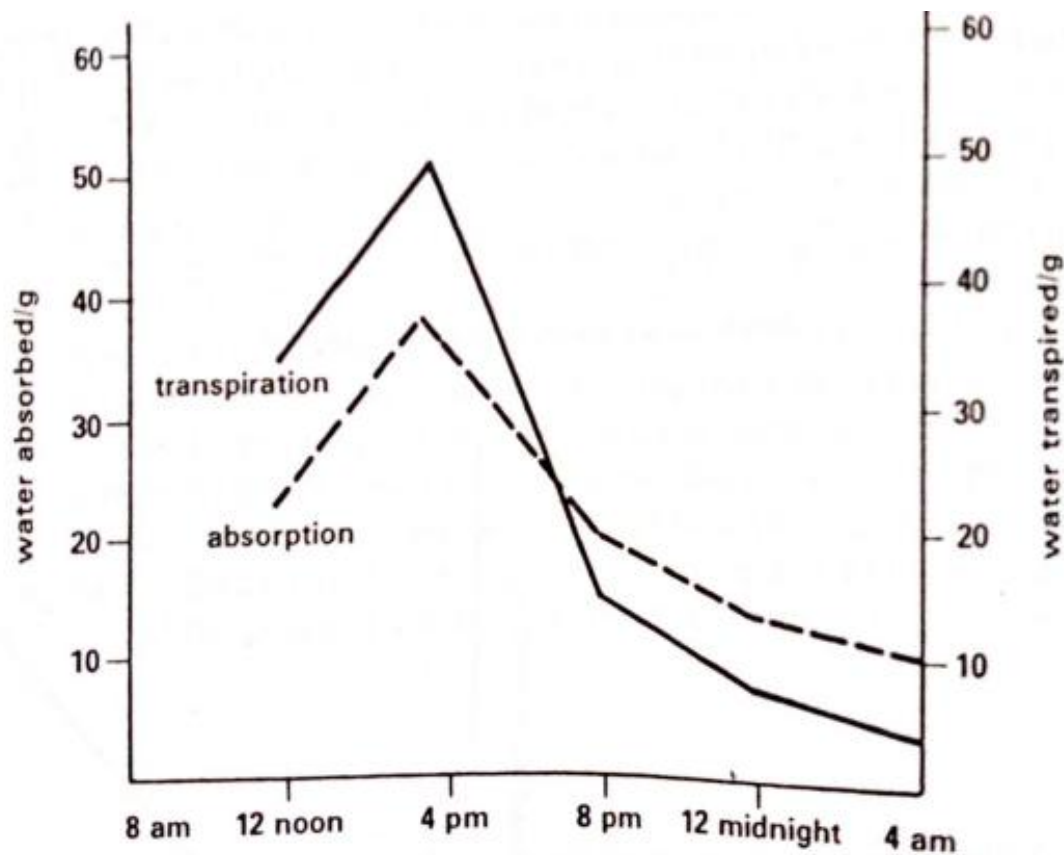
d) How are plants adapted to overcome the challenges of waterlogging.

29 a) State how increased abscisic acid levels regulates stomatal movements.

b) Explain the significance of turgor changes in the plants

c) Explain how guard cells limit water loss from a plant on a hot dry day.

30. The figure shows rate of transpiration and rate of water absorption of a sun flower plant at different times of day.



- Describe the relationship between rate of transpiration and rate of water uptake.
 - Explain the relationship described above.
 - Suggest three factors that could have influenced the changes in rate of transpiration after 15 hours.
- b) The table shows the relative number of stomata and relative rate of transpiration in four different species of plants.

Plant species	A	B	C	D
Relative number of stomata mm ⁻² of leaf (upper: lower surface)	5:30	0:40	10:15	0:50
Relative transpiration rate (upper: lower surface)	10:12	0:4	15:30	20:50

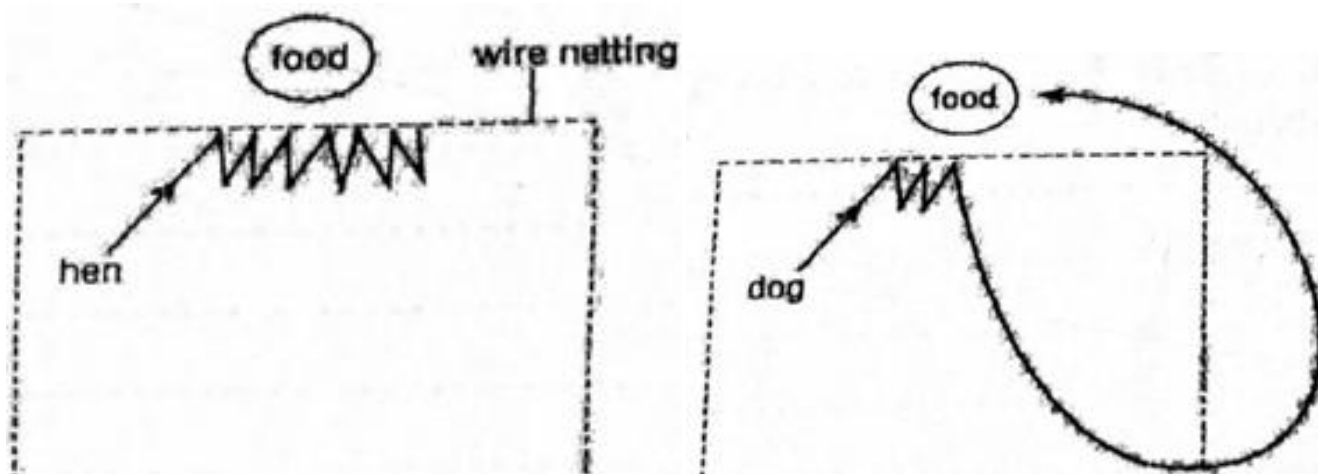
- Comment on the distribution of stomata in the four species.
 - Explain the relationship between the distribution of stomata and the rate of transpiration in; species B, and species D.
 - From the data, what conclusions can be drawn about the difference between the upper leaf surface of species B and D.
- c) Differentiate between transpiration and guttation.

SEETA HIGH MAIN CAMPUS

- 31.(a) i) With an example explain what is meant by releasers.
- (ii) State the forms of behavior that are prompted by releasers.
- (iii) Give the functions of releasers in animal behavior.

(iv) Describe ways how hormones may influence an animal's behavior.

b) The figure shows the behavioral response of a mammal and a bird towards a visible food source. Both animals were first starved and then confined in a wire netting with one end left open.



- Explain the behavioral response of each animal.
- State the form of behavior shown by the mammal.
- State three characteristics of this type of learning.

32. a) State four ideas put forward in Mendelian work on genetics.

b) What is meant by each of the following?

i) sex limited character

ii) sex influenced character

c) In cats short hair is dominant over long hair, the gene involved is autosomal. Another gene which is sex linked produces hair color, its alleles produces black or white coat color and the heterozygote combination produces tortoise shell color.

i) If a long haired black male is mated with a tortoise shelled female homozygous for short hair, what kind of offspring will be produced in F1?

ii) If F1 cats are allowed to interbreed freely among themselves, what are the chances of obtaining long haired males?

iii) Apart from being sex linked, what else can you say about inheritance of the gene for coat color?

iv) Explain why tortoise shell cats are normally female.

33. a) Describe the human physical mechanisms of temperature regulation on a cold day.

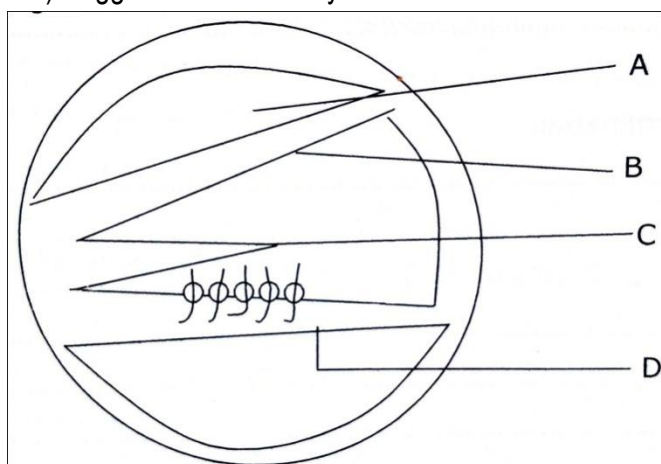
b) What are the advantages of panting to sweating.

c) Explain why panting can result into the following conditions.

i) Excessive alkalinity of blood

ii) Increased heat production

d) Suggest metabolic ways in endothermic animals used in hot conditions to control body temperature.



34. a) i) Define the term latent period of a muscle and state its significance.

ii) Briefly explain the relaxation mechanism of a muscle.

b) What is meant by Organ of Corti?

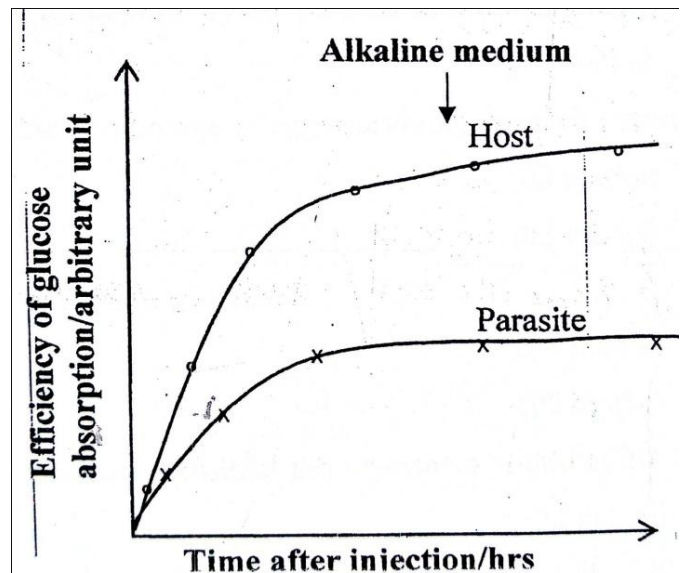
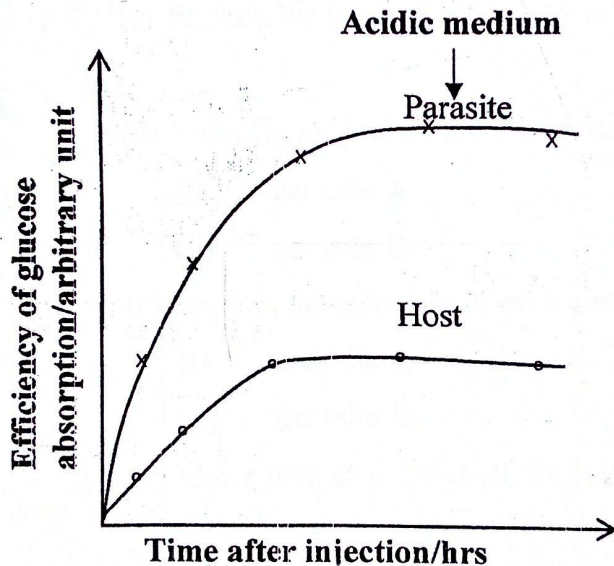
c) Study the diagram of cochlea below and answer the questions that follow.

i) Name the labeled parts

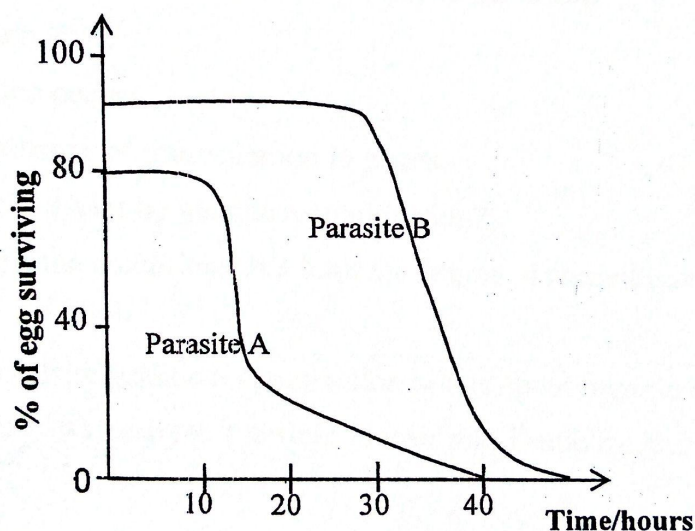
ii) Explain how part D participates in;

- ✓ Sound perception; intensity determination; pitch determination

35. Tapeworms naturally secrete hydrogen ions into the intestinal lumen of their hosts so that the carrier proteins in their cell membrane binds with more glucose molecules. In an experiment on a dog that had been infected with tapeworms, the dog was given a glucose solution and then an acidic solution injected into its intestinal lumen. The experiment was repeated using an alkaline solution. Figures below show efficiency of absorption of glucose by the host and the parasite.



In another experiment on a dog infected by two different parasites, two drugs were separately used to eradicate the parasites. Drug 1 was injected into the blood stream while drug 2 was injected into the intestinal lumen. Then the percentage of eggs of each parasite that survived after injection of the drugs was determined. The figure 2 shows the results of the investigation



- Compare the efficiency of glucose absorption by the parasite and host in;
 - acidic medium.
 - alkaline medium
- Explain the difference in the efficiency of glucose absorption in each medium in;
 - acidic medium
 - alkaline medium
- Explain the bend of efficiency of glucose absorption by the parasite in acidic medium.
- From figure 2, describe the variation in the percentage of eggs surviving for each parasite.
 - parasite A
 - parasite B
- Explain the response of each parasite to the drugs given.
 - parasite A
 - parasite B

- Other than absorption of the host nutrients, suggest ways the tapeworm would affect the dog.
- What benefits does the tapeworm gain from living in the dog's intestinal lumen?

36. In an experiment, equal numbers of leaf discs were cut out from leaves of two groups of plants of the same species. Group A was obtained from a habitat that is in open light while Group B was obtained from under the canopy of a forest. The discs were then floated in water containing sodium hydrogen carbonate and the rate of uptake (+) and release (-) of carbon dioxide at varying light intensities was determined. The results are shown in figure 1. Use this information and figure 1 to answer the questions that follow.

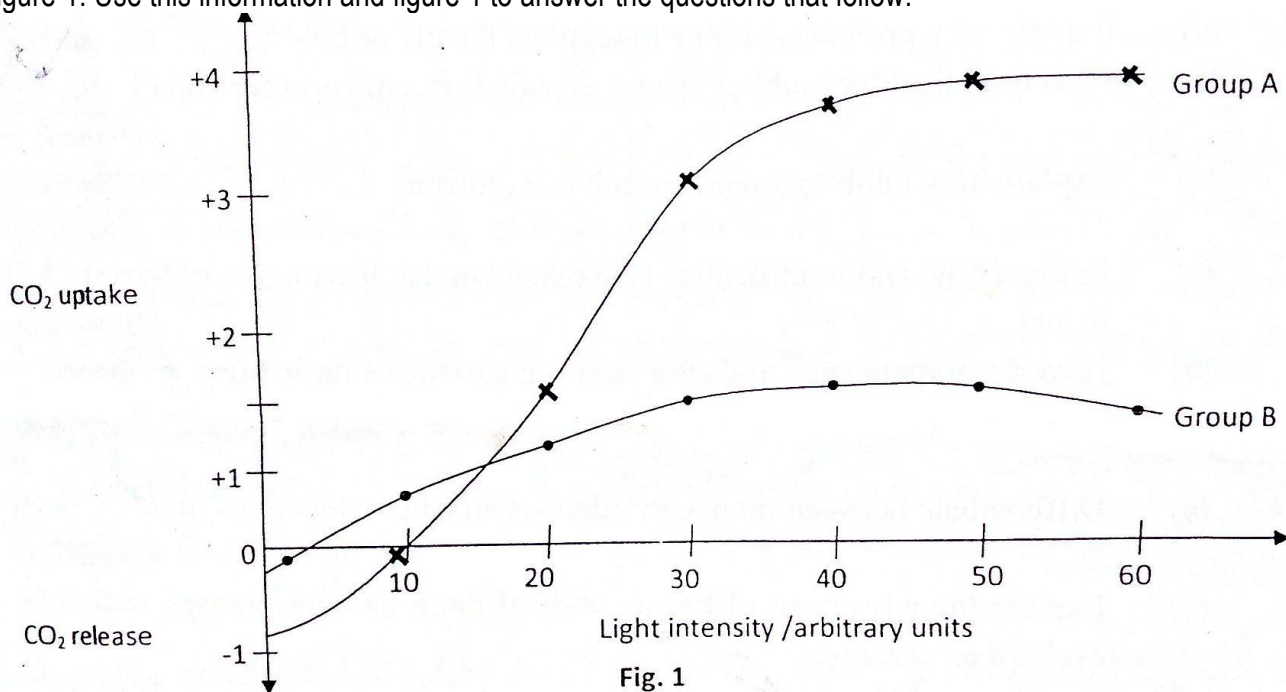
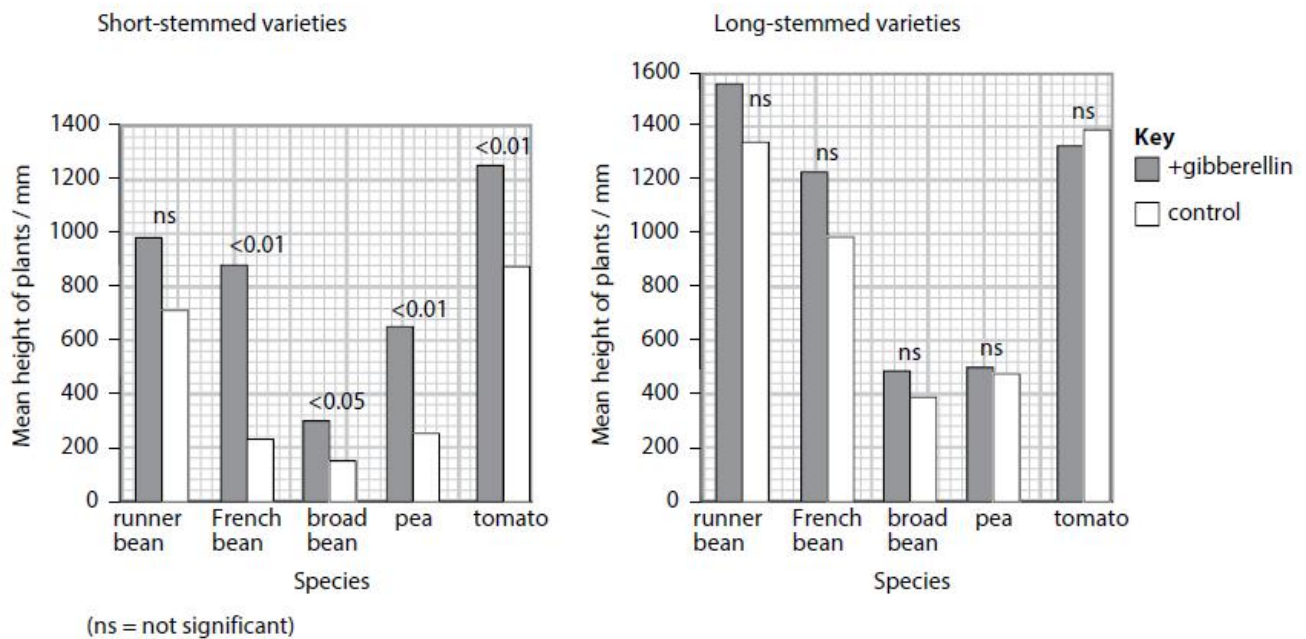


Fig. 1

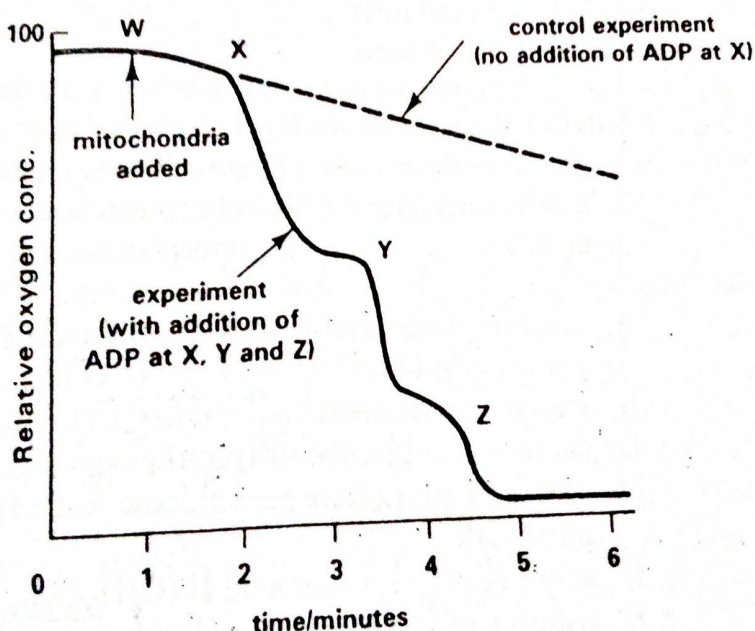
- Describe the change in rate of carbon dioxide uptake and release for group B.
- Compare the effect of light intensity on the rate of carbon dioxide uptake and release in the two groups of plants.
- Explain the changes in rate of carbon dioxide up take for group A.
- From the figure;
 - Explain why the rate of carbon dioxide release decrease with increase in light intensity.
 - Explain the advantage of having a lower compensation point for group B in their habitat.
- Suggest and explain how carbon dioxide up take would be affected if the stems of group A were used instead.
- Explain why each of the following were done:
 - Addition of sodium hydrogen carbonate to water.
 - Plants of the same species but grown in different habitats were used.
 - Same number of leaf discs were used for each experiment.
- Explain the importance of the information shown in figure 1 to humans.

37. a) Distinguish between *synergism* and *antagonism* as applied to plant responses.

b) In an investigation of the effects of gibberellin, plants of short-stemmed and long-stemmed varieties of five cultivated species were grown from seed. The young plants of each species were divided into two groups. One group of plants was sprayed with a solution of gibberellin each day. A control group was sprayed with the same volume of water. After eight weeks, the stem length of each plant was measured and means calculated for each group of plants. A statistical test was carried out to determine whether the difference between the treatments for each species was significant. The results are shown in the figure below.



- Using the information in the figure, describe the effect of adding gibberellin solution to the two varieties of the five species.
 - Explain why the short-stemmed variety of pea showed a more significant growth in height when treated with gibberellin than the long-stemmed variety.
 - Suggest the advantages of cultivating crops of short-stemmed varieties of peas and beans rather than long-stemmed varieties.
- Explain the advantages to plants of having fast responses to stimuli.
 - The all-or- nothing law applies to animals during impulse transmission, explain how the law is applied in plant responses.
 - Suggest the advantage to Venus flytrap of digesting insects.
 - Outline how auxins stimulates elongation and growth in the shoot.
 - When gibberellins are applied to dwarf pea plants, the plants grow in height. Explain what this tells us about dwarfness in pea plants.



38. In an experiment with mitochondria a medium which contained inorganic phosphate and oxidisable substrates was used. The medium was saturated with air at the start. The experiment determined the fall in oxygen concentration in the medium when firstly mitochondria, and then ADP, were added. A standard amount of ADP was added at X, a similar amount at Y, and at Z.

- Why was inorganic phosphate added to the medium?
- Explain why the oxygen concentration slightly dropped after adding ADP at X.

