

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

INTRODUCTION MESSAGE

Members we thank the almighty for our safety on way from respective schools to RINES SS Namusera - Wakiso for biology seminar on this day Sun 16th Jun 2019. Here is a deal for you and I. in order to attain desired scores in our UCE final examinations; kindly note them with concern.

1. **How can I succeed in Biology examinations?** By simply *planning* before an examination. This involves looking at past paper questions for the syllabus being taken thus getting used to *styles* of the questions and *words used by examiners*, not relying a lot on last minute revision therefore one should *convince yourself* about how much is known.
2. **How do I then answer a biology question?** Students failing to answer questions is a very common complaint of examiners of national examinations and results from; answer being *too long*, answer being *too short*, *irrelevant* materials included, relevant materials excluded, absence of diagrams/calculations/graphs that are clearly asked for, entire parts of the question missing etc. Answering a question is a *skill that will gradually be perfected* as one practice throughout the course and questions provided in this seminar are to help you develop a *good answering technique*. For practical questions you are advised to read the whole question before you start doing, spend a few minutes thinking about the best way to arrange apparatus to save time when carrying out the experiment and making accurate observations.
3. **What are some of the basic examination techniques during the examination?** Success in final examinations comes from proper preparations and positive attitude to the examination. During an examination you should; (i) keenly read all parts of the questions. (ii) Not spend too much time on one question. (iii) Call invigilator immediately u have any problem. (iv) Write in short sentences avoid too many buts and ands in mid sentences. (v) Plan before answering questions. (vi) Not spend a lot of time checking for mistakes until they have completed the required number of questions.

I acknowledge SIR NSUBUGA SWAIBU and SIR ARUM LAWRENCE in this publication.

Dearests I welcome you once again and wish you a very nutritious Biology seminar; and journey mercies on our way back to respective schools when time comes Isha Allah.

Yours faithfully;



Semmanda Charles Zziwa

aka SCZ Salongo

HOD Biology Rines ss Namusera

"A dream doesn't become reality through magic, it takes sweat, determination and hard work. Success is a result of perfection, hard work, learning from failure, loyalty and persistence. There are no secrets to success. It is the result of preparation, hard work and learning from failure. We struggle to mentor you our students because we want you to become the perfect reflection of our abilities!!!!!!.....From ABE"

Page 1 of 43

By; NSUBUGA SWAIBU (Gladiator) 0703-719086, ARUM LAWRENCE (Bronsted) 0703-923836 AND SEMMANDA CHARLES ZZIWA [SCZ Salongo] 0705-950374, semmandazziwa@gmail.com

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

1. (a)(i) What is an aerofoil? (01 mark)
 (ii) With the aid of a diagram, describe how the shape of a bird's wing generates lift. (05 marks)
 (b). Explain how the following suit the bird to flight.
 (i) Blood and circulatory systems. (07 marks)
 (ii) Nervous system. (03 marks)
 (iii) Digestive system. (02 marks)
 (c). What are the reasons for locomotion of animals. (03 marks)
2. (a) Describe the mechanism in flowers which favour
 (i) Inbreeding (03 marks)
 (ii) Out-breeding (03 marks)
 (b). State the genetic consequences of inbreeding and out-breeding in flowering plants. (08 marks)
 (c). Explain why
- (i) In dioecious plants male are associated with dry soils while females are associated with moist (01 marks)
 (ii) Nearly all dioecious plants are wind pollinated. (02 marks)
 (ii) Why dioecism is common in animals than in plants (01 marks)
 (d) Suggest reasons why dioecious plants are rare than monoecious plants despite the advantages of cross pollination. (02 marks)
3. (a) Give an account of the process of gametogenesis in a flowering plant (12 marks)
 (b). How are plants adapted to reproduce on land? (08 marks)
4. (a). What is meant by Learning? (01 mark)
 (b). Using relevant examples, state and explain the various types of learned behavior. (08 marks)
 (c)(i). what is meant by motivation. (02 marks)
 (ii) Give the significance of motivation in animals. (03 marks)
 (d)(i) Distinguish between circadian and circannual rhythms. (02 marks)
 (ii) What is the significance of biorhythms? (04 marks)
5. (a.) Distinguish between translation and transcription. (05 marks)
 (b). Describe the process of translation in living organisms (12 marks)
 (c). what is the significance of translation in living organisms? (03 marks)
6. (a). Explain the mechanisms by which each of the following organs conserve and maintain water balance.
 (i). Mammalian kidney (07 marks)
 (ii). Insect Malpighian tubule (05 marks)
 (b)(i) Define the term counter current exchange system. (02 marks)
 (ii). State the significance of any three (03) counter current exchange systems to different groups of animals. (06 marks)
7. (a). Describe the structure of an anther of a flowering plant (05 marks)
 (b). Describe the events that lead to;
 (i). Double fertilization in flowering plants (05 marks)
 (ii). Ovulation in human females (06 marks)
- (c). Give four differences between the stamens of insect pollinated and wind pollinated flowers. (04 marks)
8. (a). Describe the principle of movement in an earthworm. (09 marks)
 (b). How does a skeletal muscle contract when stimulated. (11 marks)
9. (a) Describe the changes in the human fetal circulation immediately after birth. (10 marks)
 (b). Discuss the effect of the amount of yolk on the process of cleavage and gastrulation. (10 marks)
10. (a). Explain how the following factors influence the process of speciation
 (i) Types of pollination (04 marks)
 (ii) Species richness (02 marks)

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

(iii) Artificial selection (03 marks)

(b). Account for the process of evolution by the following;

(i). resistance of bacteria to antibiotics (05 marks)

(ii) Prevalence of the sickle cell trait in the tropics (06 marks)

11. (a). Explain how the placenta serves as;

(i) A barrier (04 marks)

(ii) A link between the mother and the fetus (03 marks)

(b). Describe how hormones control pregnancy in mammals (12 marks)

12. (a). Distinguish between cell and nuclear division.

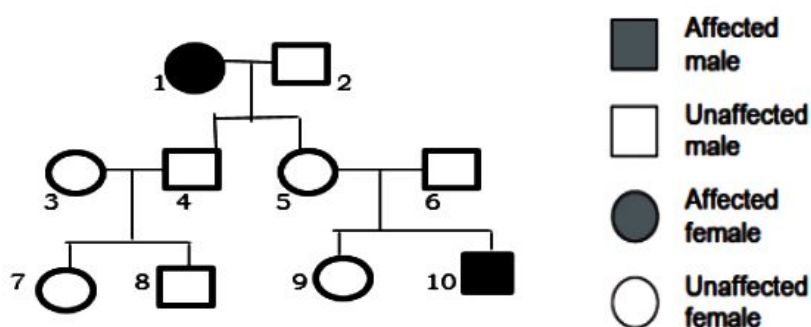
(b). What are the advantages and disadvantages of an organism in having meiotic divisions as part of its life cycle, compared with one that reproduces only by mitosis. (08 marks)

(c). Three organisms found on a previously undiscovered and isolated island were investigated for the number of chromosomes found in their cells. The results were as follow;

Organism	Individual	No. of Cell	Chromosome No
Lunkygrobe	A	-Almost all cells	16
		-A few cells	8
Speckled bobbit	A	All cells	39
	B	All cells	38
Slippery toot	A	All cells	17

In each case, provide an explanation for the different number of chromosomes found in the cells and give an example of a corresponding situation in the human biological world. (12marks)

13. The diagram below shows a pedigree for fibrocystic disease.



(a)(i). using the above diagram, state whether the allele for cystic fibrosis is recessive or dominant. Give two reasons for your answer. (03 marks)

(ii). Explain how you could conclude from the above information that the allele for fibrocystic disease is not located on either the X or the Y chromosome. (03 marks)

(iii). Which individuals in the pedigree are definitely heterozygous (1½ marks)

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

(iv). Since individuals 5 and 6 have one affected child they decided to seek advice of a genetic counselor before having further children. What is the chance of their next child being affected?

Explain your answer.

(03 marks)

(v) In the past, people with cystic fibrosis usually died before reaching adulthood. Suggest an explanation for the fibrocystic allele remaining at a relatively stable level in the population inspite of this.

(02marks)

(b). M and N are the antigens that occur in the blood where a population of 416 individuals were tested for the presence of these alleles, the results were as follows

Antigen(s) present	No. of individuals
Nonly	238
Nonly	26
Both	152

Assuming that the presence of MN antigens is the result of inheritance of one pair of alleles, calculate the frequencies of the two alleles and expected Hardy- Weinberg genotypic ratios. Is the population in Hardy-Weinberg equilibrium?

(8 ½ marks)

14. (a). Describe how secondary thickening occurs in dicotyledonous plant.

(10 marks)

(b). How is the structure and distribution of the xylem tissue related to its function? **(10 marks)**

15. (a). Describe the structure of the liver lobules.

(08 marks)

(b). How does the mammalian liver deal with excess proteins in the body.

(06 marks)

(c). Explain the functioning of the liver kupffer cells in that mammalian liver.

(06 marks)

16. (a) Compare the main features of fungi and a typical plant .

(06 marks)

(b). Describe the symbiotic relationships between fungi and

(i). Algae

(08 marks)

(ii) Plant roots

(06 marks)

17. (a) How is carbon dioxide fixed in a sugar cane plant?

(08 marks)

(b). How do the following affect plant distribution

(i). altitude

(06 marks)

(ii). day length

(06 marks)

18. (a). what is meant by

(i). apical dominance

(03 marks)

(ii). abscission

(03 marks)

(b). Explain how sensitivity of plants to light affects the process of flowering.

(10 marks)

(c). Suggest ways in which auxins have been utilized for commercial farming.

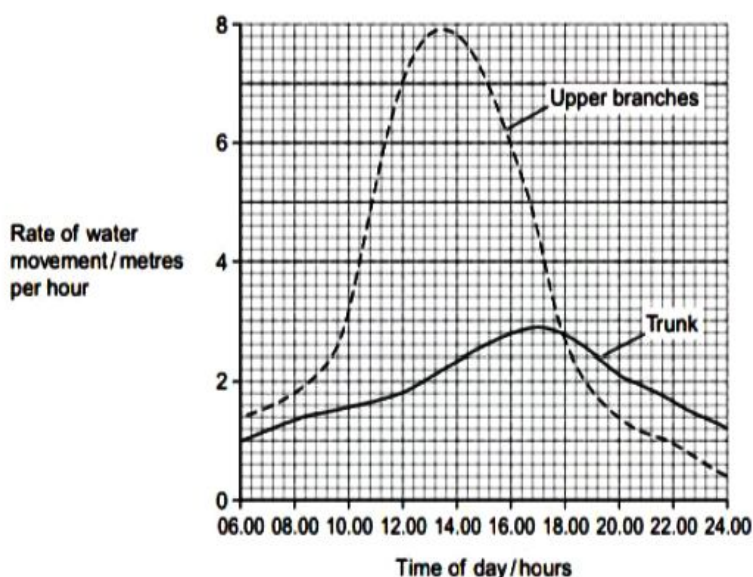
(04 marks)

19. Describe the cause of root pressure, and clearly state its role in the ascent of water up a plant.

(b) A graph in the figure below shows the rate of water movement over a 24-hour period

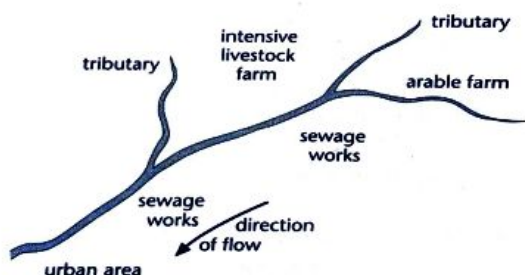
in different parts of a tree. Study it and answer the questions that follow.

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019



- (i) Describe the changes in the rate of water flow in the upper branches.
- (ii) Compare the changes in the rate of water flow in the upper branches and the trunk
- (iii) Explain how the results of the investigation support the cohesion-tension theory.
- (c) How are plant tissues for water movement adapted to this function?

- 20. (a).** Giving an example in each case, distinguish between
- (i). convergent and divergent evolution. (04 marks)
 - (ii). Lamarckism and Darwinism. (04 marks)
- (b).** Give an account of the evidence for evolution based in;
- (i) Fossil record (05 marks)
 - (ii) Vestigial organs (05 marks)
- (c).** Give two pieces of evidence to show that evolution is still in progress. (02 marks)
- 21. (a).** Describe how the structure of neurons speeds up the transmission of action potentials. (03 marks)
- (b).** Explain using a named example how sensory receptors in mammals convert energy into action potentials. (07 marks)
- (c).** With reference to synapses, explain the term summation and distinguish between the forms of summation that occur in synapses. (05 marks)
- (d).** How is transmission of impulses across synapses controlled? (05 marks)
- 22. (a).** Describe concisely the cause and the consequences of each of the following
- (i). Acid rain (03 marks)
 - (ii) Ozone depletion (03 marks)
- (b).** The figure below shows a section of a river that flows through rural and urban areas

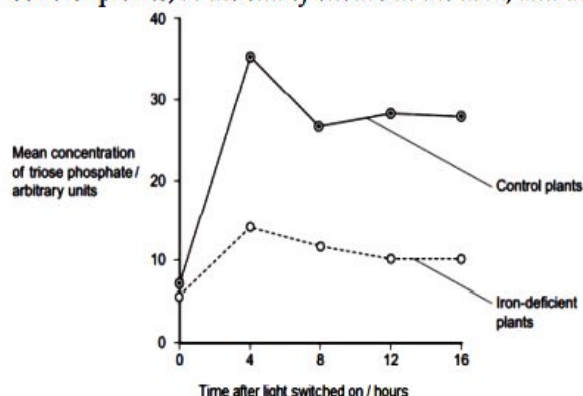


- (i) Explain how the biological oxygen demand (B.O.D) of water samples taken from the river depicted in the figure could be measured. (04 marks)
- (ii) Outline three other ways in which the quantity of water in the river may be assessed. (05 marks)
- (c) Explain the sequence of events that may lead to eutrophication of the river shown in the figure. (03 marks)

- 23.** In an experiment to investigate the effect of iron deficiency on the production of triose phosphate in sugar beet plants, scientists grew the plants under the same conditions with their roots in a liquid growth medium containing all the necessary nutrients. Ten days before the experiment, half the plants were transferred to a liquid growth medium containing no iron.

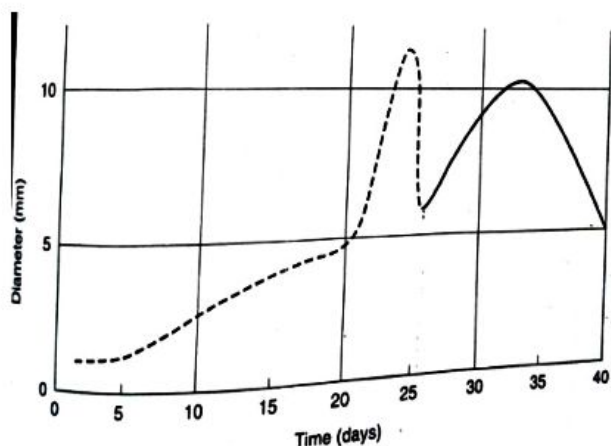
RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Figure below shows the concentration of triose phosphate produced in these plants and in some control plants; at the end of 6 hours in the dark, and then for 16 hours in the light.



- (a) Explain why
- the experiment was carried out at a high carbon dioxide concentration
 - it was important to grow the plants under the same condition up to ten days before the experiment
 - the plants were left in the dark for 6 hours before the experiment
- (b) Account for the change in the mean concentration of triose phosphate in the iron deficient plants between 4 hours to 16 hours.
- (c) Explain the effect of iron deficiency on the uptake of carbon dioxide.

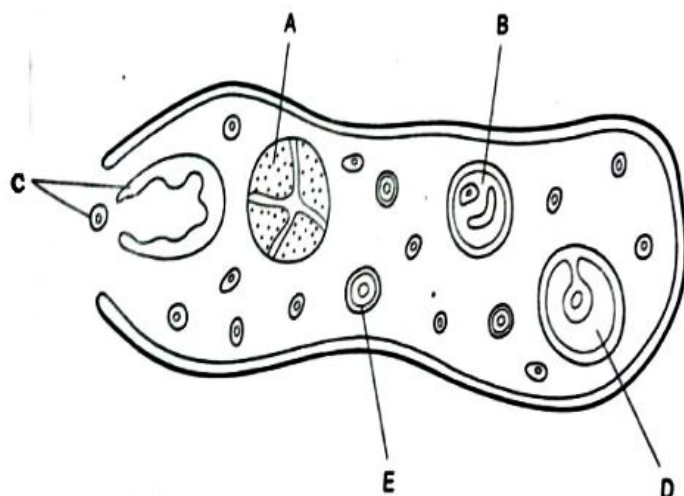
24. (a). Compare the structure of xylem and phloem. **(08 marks)**
- (b). Describe the mechanism of transport of hormones in a plant. **(12 marks)**
25. (a). In a mammalian fetus, there is an opening called foramen ovale, between the left and right atria.
- What is the function of the foramen ovale? **(02 marks)**
 - It's normal for the foramen ovale to close at birth. If this did not happen what symptoms might be experienced by the baby? **(04 marks)**
- (b). What part does the placenta play in;
- Nutrition of the embryo **(02 marks)**
 - Protection of the embryo **(02 marks)**
- (c). The graph below shows mean diameter of follicles and corpora lutea in the ovary of a pig during a 40 – day period



- What is the name of the hormone that causes the follicles to begin to increase in size around day 6? **(01 marks)**
- Between which days do you think the introduction of sperm is most likely to result in fertilization? Give reasons for your answer. **(04 marks)**
- Giving a reason for your answer say on which day you think ovulation takes place. **(02 marks)**
- What evidence support the view that fertilization did not take place? **(01 mark)**

- (d). The figure below shows section through a mammalian ovary

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

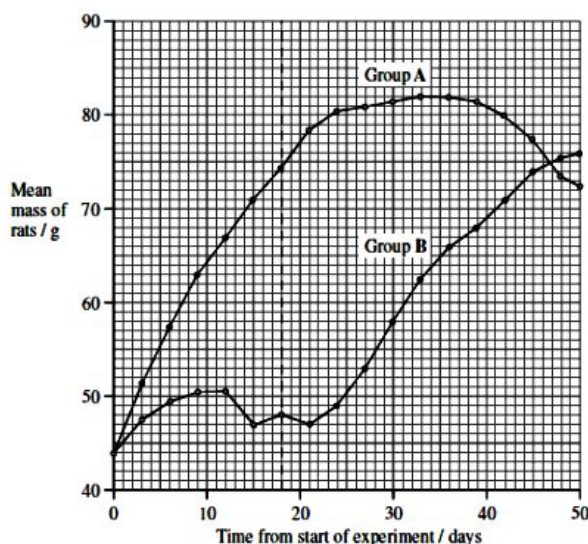


- Name the parts labeled A, B, C, D and E.
- State the correct developmental sequence of these five structures

26. (a). Distinguish between the terms **immunity** and **autoimmunity**. (02 marks)
- (b). Suggest **three** key roles played by the body's immune system. (03 marks)
- (c). State **three** ways body openings are protected from entry of pathogens. (03 marks)
- (d). State **two** human diseases resulting from autoimmune disorders (02 marks).
- (e). Hopkins carried out an experiment out to investigate the effect on growth of rats on including milk in their diet. Two groups, **A** and **B**, each consisting of eight young rats fed on a synthetic diet (mice pellets) of purified casein, sucrose, inorganic salts and water.

Group **A** received a supplement of 30cm³ of milk per day for the first 18 days then received no further milk.

Group **B** was given no milk for the first 18 days, then received a supplement of 3cm³ of milk per day.



- (a) From the graph, calculate the average growth rate of rats from the two groups **A** and **B** at;
- 0-10th day for group **A**.
 - 20th- 50th day for group **B**
- (b) (i). Compare the changes in the mean mass of both groups of rats during the whole experiment.
- (ii). Explain the changes in the mean mass of both groups of rats in c(i) above
- (d). Describe,
- the **physiological significance** of including mineral salt like calcium in the diet of rats?
 - how the rats were able to deal with excess proteins in their diet

27. An individual with **juvenile diabetes** was injected with insulin or allowed to inhale insulin (a recent product administered using a nasal spray).

Figure 1.1 shows the concentration of insulin in the blood plasma in the 480 minutes after injecting or inhaling insulin. In both cases insulin was of the same type obtained from a genetically engineered *Escherichia coli*.

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Figure 1.2 shows the concentration of glucose in the blood plasma in the 480 minutes after injecting or inhaling insulin.

Study both graphs and use them to answer the questions that follow.

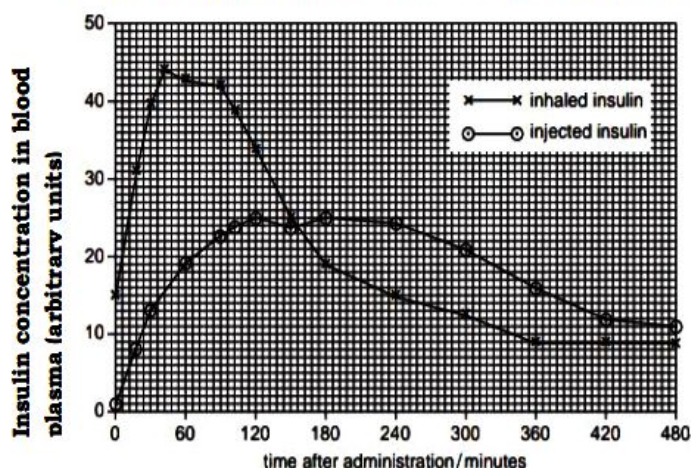


Fig 1.1

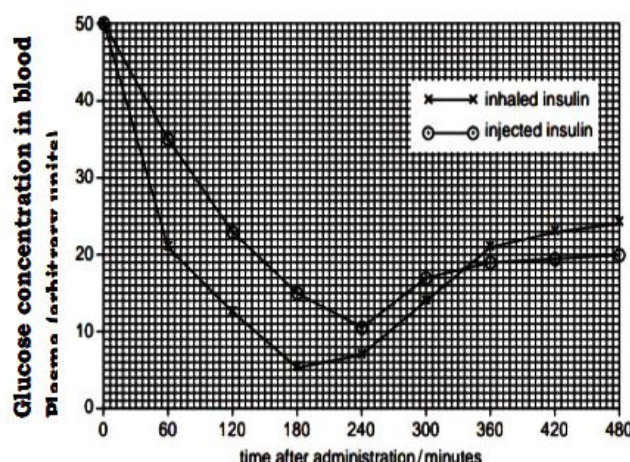
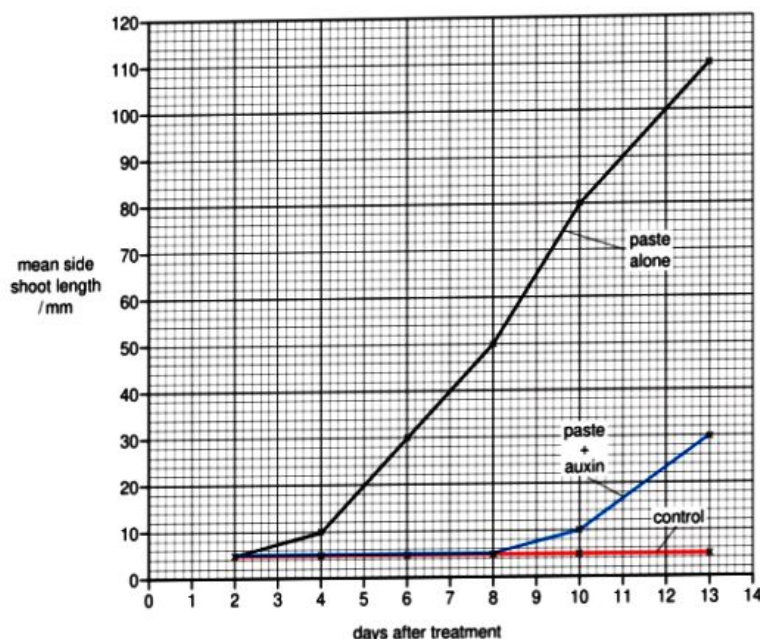


Fig 1.2

- (a) What are causes and symptoms of juvenile diabetes?
 - (b) Compare the levels of injected insulin and inhaled insulin in the blood plasma.
 - (c) Explain the effect of injected insulin on the blood glucose concentration
 - (d) Suggest the advantages and disadvantages of inhaling insulin rather than injecting insulin.
 - (e) Explain the need for regulation of blood glucose concentration
- 28.** (a) (a) What is meant by the term apical dominance.
- (b) An investigation was carried out into the effects of a plant growth regulator, auxin (IAA) on apical dominance.
- The apical buds of 20 pea plants were cut off and discarded
 - The cut surfaces of 10 pea plants were coated with inert paste containing auxin
 - The cut surfaces of the other group of 10 pea plants were coated with inert paste alone.
 - A further group of 10 pea plants did not have their apical buds removed and were not coated with paste.

The lengths of the side shoots of plants in each of the three groups were measured at regular time intervals and mean values calculated. The results are shown in the figure below.

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019



(i) Explain why side shoots increase in length when the terminal buds are removed.

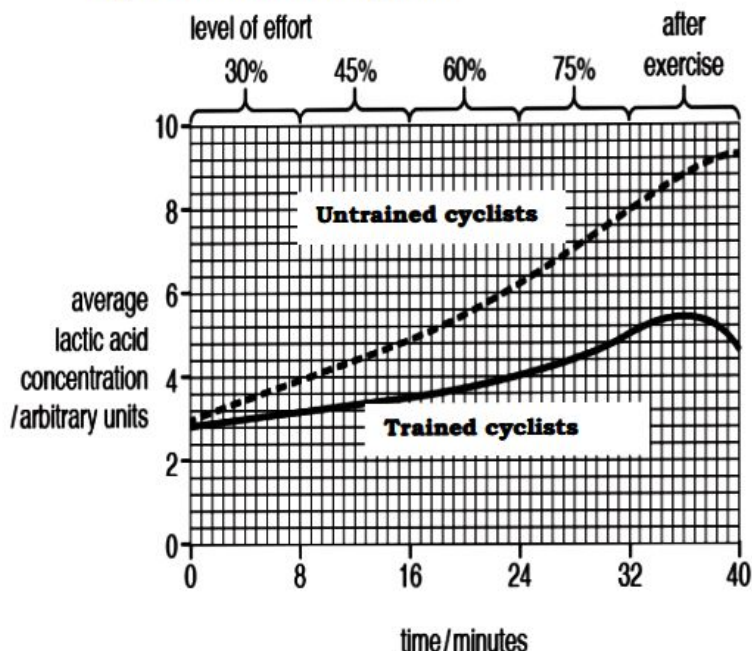
(ii). Calculate the percentage difference at 13 days in the mean length of side shoots of plants treated with paste alone compared with the plants treated with paste and auxin.

(iii) Compare the variation in the mean length of side shoots of plants treated with paste alone and plants treated with paste and auxin.

(iv) Explain the variation in the mean length of side shoots with paste + auxin.

(v) How can the phenomenon demonstrated above be used in agriculture?

29. In an investigation on the effect of increasing level of exercise, a group of trained and untrained cyclists were each allowed to cycle at four levels of effort; 30%, 45%, 60% and 75% of their maximum speed. They cycled for eight minutes at each level of effort. Figure below shows an average production of lactic acid in the blood of the trained and untrained cyclists in this investigation.



(a) Predict and explain what would happen to the pulse rate of all the cyclists during the exercise.

(b) Describe the changes in the average lactic acid concentration in the blood of the untrained cyclists during and after the period of exercise.

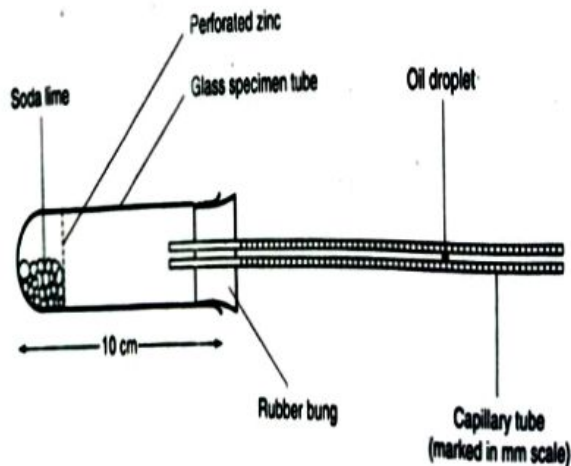
(b) Explain why the lactic acid concentration in the blood in trained cyclists differ from the untrained cyclists eight minutes after the exercise.

(c) Describe the process leading to production of lactic acid during cycling by the two groups of cyclists.

(d) What is the fate of the lactic acid produced during cycling by the two groups of cyclists?

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

30. Below is a diagram a simple respirometer which is used to measure the volume of oxygen tension up by organisms.



(a). (i) Suggest an organism that could be used in the apparatus. **(01 mark)**

(ii). Describe how the apparatus works and how you would use it. **(10 marks)**

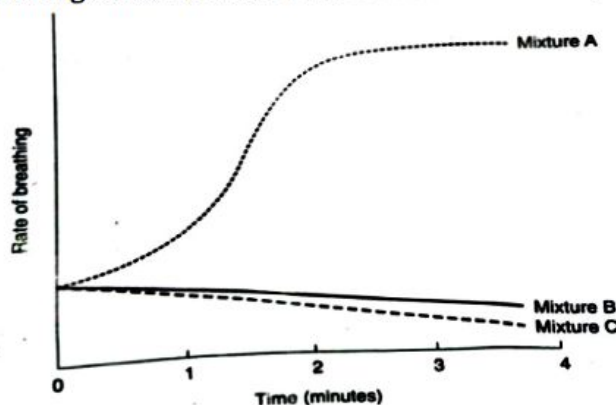
(b). List four sources of error that could arise when using the apparatus. **(04 marks)**

(c). State four factors that could alter the rate of oxygen up take by organisms in the apparatus

(d). If, during one experiment, the oil droplet moved 50mm in 10 minutes and the total mass of the organisms in the glass specimen tube was 4g, calculate the volume of oxygen taken up per hour, per gram of organism. **(05 marks)**

Nb. The capillary tube has a uniform bore of 1.0mm.

(e). In another experiment a subject was given various gaseous mixtures to breathe and the rate of breathing measured. The results are shown below;



Mixture A = 90% oxygen + 10% Carbon dioxide

Mixture B = Normal atmospheric air

Mixture C = 100% oxygen

(i). Explain what the data shows concerning how the rate of breathing is controlled. **(02 marks)**

(ii). In the light of the information provided by the graph showing mouth to mouth resuscitation is a better means of artificial respiration than pressing on the chest wall. **(04 marks)**

(f). Explain fully why it is more dangerous to re- breathe expired air if it is first passed through soda lime. **(05 marks)**

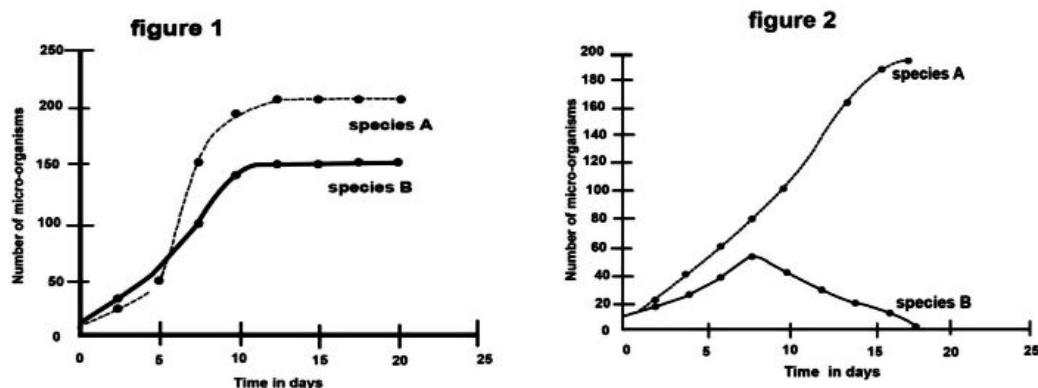
(g). An athlete has a maximum air intake of 20dm³. She can incur oxygen debt of 14dm³ before she collapses. Running at 5msec⁻¹, she uses oxygen at a rate of 0.3dm³sec⁻¹. How far can she run before collapsing? **(04 marks)**

31. The population growth of two related aquatic organisms of **specimens A** and **B** were investigated together in two sets of culture media. In the first set, both species were cultured in long and cylindrical vessels while in the second set the micro- organisms were cultured in shallow petri - dishes.

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Figure I below shows the population growth pattern of species A and B in the first set while **Figure II** shows the population growth pattern of species A and B in the second set

Study the figure carefully and use them to answer the question that follows;



(a). Describe the population growth patterns of the two organisms A and B cultured in the shallow petri- dishes **(07 marks)**

(b). Outline the differences in the population growth patterns of the two species in both sets (shallow petri – dishes and long cylindrical vessels)

(c). Explain the differences in the population growth pattern observed in (b) above. **(15 marks)**

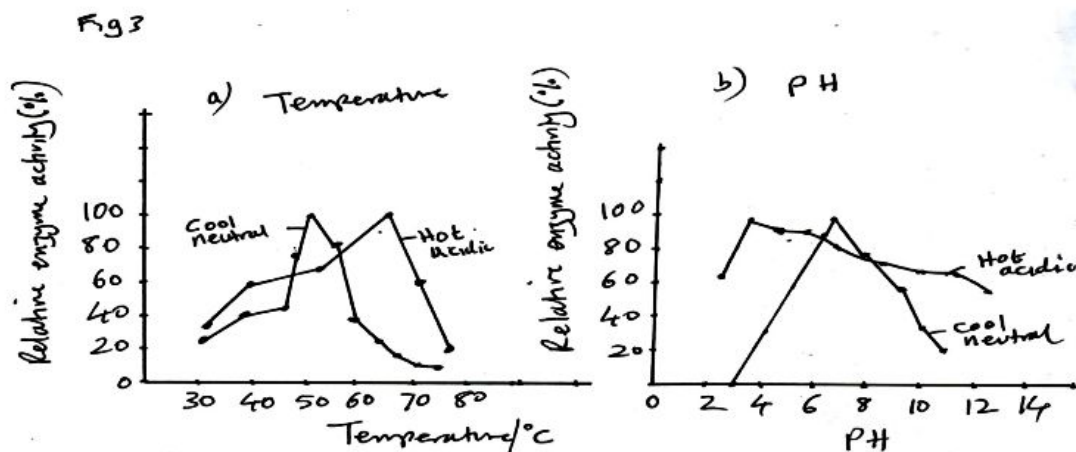
(d). Describe a suitable method that can be used to determine the population of the micro-organisms being investigated. **(07 marks)**

(e). Explain external factors that limit the population growth of micro- organisms in the culture medium.

32. (a) Explain briefly the meaning of the following terms in relation to enzyme structure and activity. **(08 marks)**

(i) Prosthetic group (ii) Co-enzyme (iii) Active site (iv) Activators

(b) Figure below shows the activity of bacterial enzymes at different PH and temperature



Which graph represents the bacteria that live in?

- (i) Cool and neutral conditions
- (ii) Hot and acidic conditions

(1/2 mark)

(1/2 mark)

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

(c) Compare the changes in enzyme activity with temperature and PH for organisms that live in hot and acidic environment to those that live in cool and neutral environment. **(04 marks)**

(d) With reference to enzyme structure explain how the following factors affect enzyme activity

(i) PH

(02 marks)

(ii) Temperature

(01 mark)

(e) Explain why the same enzyme may be able to work at different optimum PH and temperature conditions in similar organisms living in different environments. **(02 marks)**

(f) Cellobiose and maltose are both disaccharides. Explain why amylase enzymes produced by microorganisms in the rabbit's gut are unable to digest cellobiose. **(02 marks)**

33. Two mammals A and B were subjected to different environmental temperatures and each time the temperatures were varied, their metabolic rates were determined. The results were tabulated as shown in table below;

Environmental temperature/°C		-20	-15	-10	-5	0	5	10	15	20	25	30	35	40	45
Relative metabolic rate	Mammal A	4.0	3.5	3.1	2.6	2.2	1.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Mammal B	-	-	-	-	-	5.0	4.0	3.0	2.0	1.1	1.1	1.1	1.1	1.1

(a) Plot suitable graphs to show the relationship between environmental temperature and relative metabolic rate. **(06 marks)**

(b) Describe the changes in the relative, metabolic rate seen in each of the graphs you have plotted. **(06 marks)**

(c) Explain the observed metabolic rates between

(i) 10-20°C.

(10 marks)

(ii) 15- 40°C and 25-40°C for mammal A and B respectively.

(02 marks)

iii) Above 40°C.

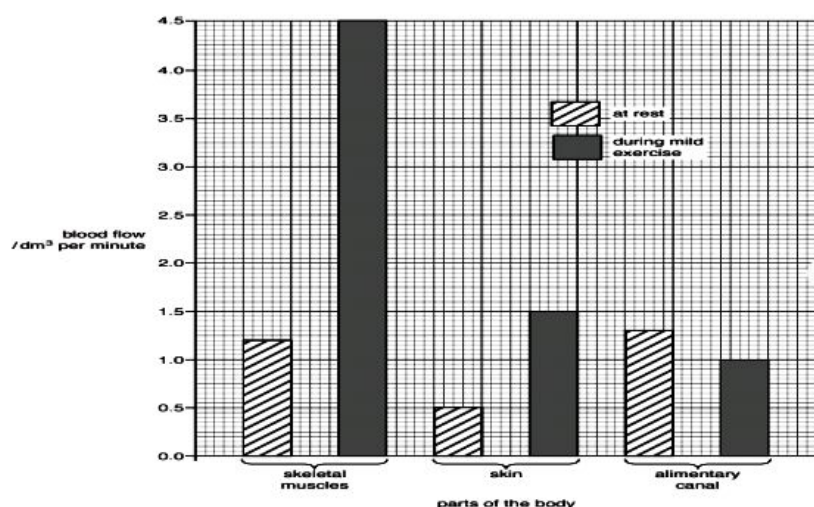
(06 marks)

(d) Suggest why the experiment fails to determine the relative metabolic rate of mammal B at temperatures below 5°C and above 50°C. **(02 marks)**

(e) Assuming that these mammals show very close evolutionary relationships, distinguish between their relative sizes and show how they are related to their survival strategies in different environmental conditions. **(07 marks)**

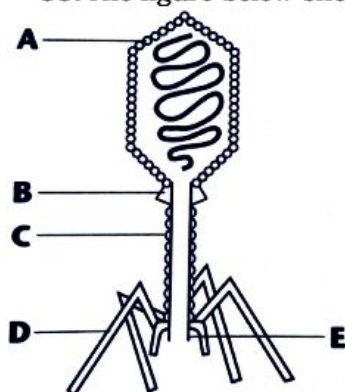
34. An investigation was carried out into the blood flow in different parts of the body when resting and during a mild exercise. Figure below shows results for the skeletal muscles, the skin and the alimentary canal.

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019



- (a). Calculate the percentage change in blood flow to the
- alimentary canal
 - skin
 - skeletal muscles during exercise.
- (b) Account for observed trends in the blood flow to the body parts shown in the figure.
- (c) Explain the following observations
- blood flow to the brain stay the same during rest and exercise
 - blood flow to the heart muscle increases when the person exercises.
- (d) How is blood flow in the veins controlled?

35. The figure below shows a labelled diagram of a bacteriophage.

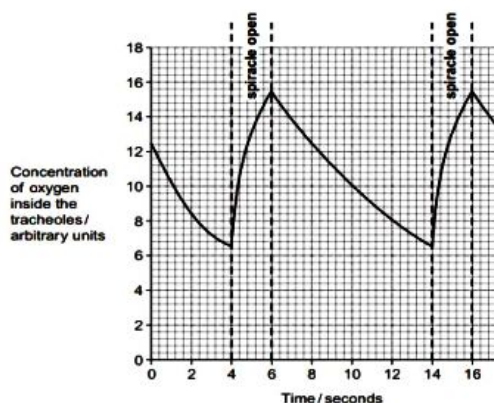


- (a) Name the group of microorganisms which includes bacteriophages. (03 marks)
- (b) Using the letters on the figure, identify the region;
- Involved in the attachment to bacteria
 - Involved in penetrating bacterial cells
 - Containing genetic information
- (c) Describe the life cycle of a named bacteriophage. (12 marks)
- (ii) Discuss the various ways in which bacteria maybe harmful and beneficial to man. (05 marks)

36. The table below shows the mean rate of abdominal pumping of an insect before and during flight.

Stage of flight	Mean rate of abdominal pumping (dm ³ of air kg ⁻¹ hr ⁻¹)
Before	42
During	186

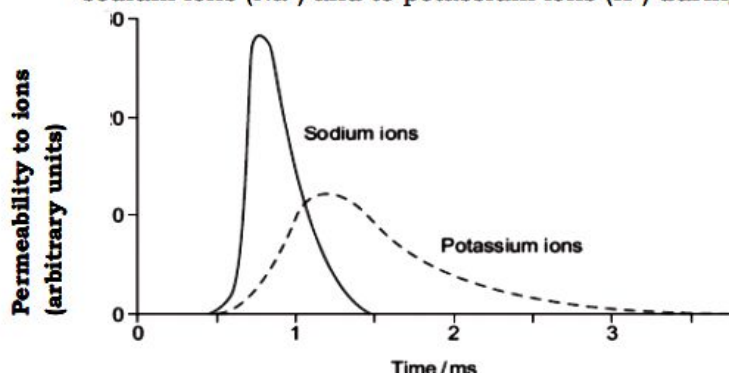
- (a) (i) What is meant by 'abdominal pumping?'
- (ii) Calculate the percentage increase in the rate of abdominal pumping before and during flight.
- (iii) Account for the difference in the mean rate of abdominal pumping before and during flight.
- (iv) Explain the absence of abdominal pumping in many small insects.
- (b) The figure below shows results of an experiment to measure the levels of respiratory surface of an insect over a period of time. During the experiment, the opening of the insect's spiracles was observed and recorded.



- Calculate the frequency of spiracle opening
- Explain the effect of spiracle opening on the oxygen concentration in the tracheoles.
- Explain the difference in the frequency of spiracle opening in aquatic and terrestrial insect.
- Explain how oxygen delivery to tissues of insects controlled during exercise.

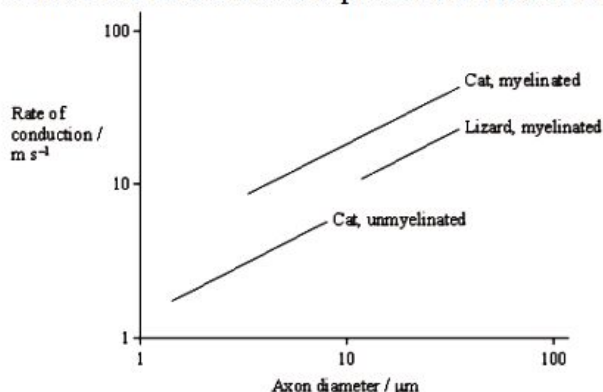
RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

37. During an action potential, the permeability of the cell-surface membrane of an axon changes. The graph in fig 10.1 below shows changes in permeability of the membrane to sodium ions (Na^+) and to potassium ions (K^+) during a single action potential.



- (a). (i) What is an action potential?
 (ii) Explain the shape of the curve for sodium ions between 0.5ms and 0.7ms
 (iii) During an action potential, the membrane potential rises to +40Mv and then falls. Using information from the graph, explain the fall in the membrane potential.
 (iv) Explain how the resting potential is re-established during exercise.

(b) A graph in figure 10.2 shows the relationship between axon diameter, myelination, and rate of conduction of the nerve impulse in a cat and a lizard.



- (i) Explain the effect of myelination and axon diameter on the rate of nerve impulse conduction
 (ii) Account for difference in rate of conduction of nerve impulse in myelinated neurons in cats and lizards for the same diameter of axon
 (iii) The cat was diagnosed of multiple sclerosis. Suggest and explain how this may affect the transmission of nerve impulse.

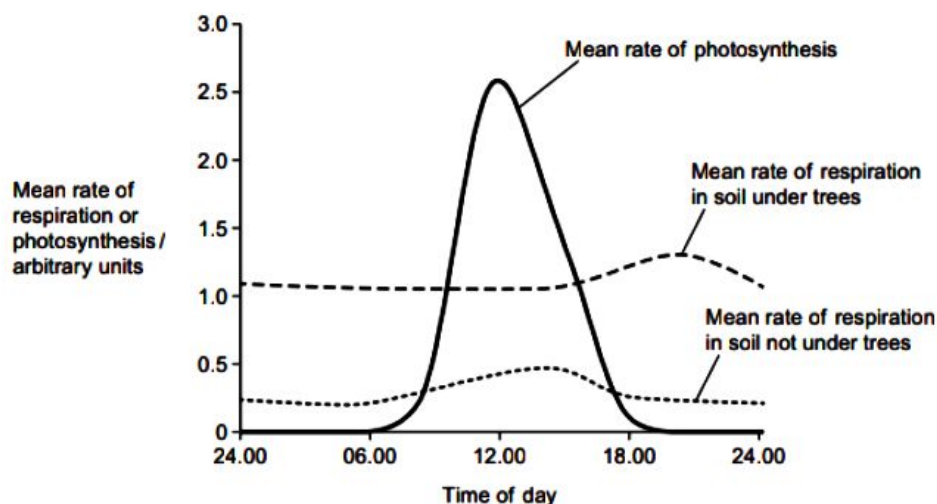
38. The table below shows mean rate of carbon dioxide production during the dark in three parts of an ecosystem. Study it and answer the questions that follow.

	Part of ecosystem		
	Leaves of plants	Stems and roots of plants	Non- photosynthetic soil organisms
Mean rate of carbon dioxide production($\text{cm}^3 \text{m}^{-2} \text{s}^{-1}$)	0.032	0.051	0.045

- (a) (i) What measurements would have been made in order to calculate the rate of carbon dioxide production?
 (ii) Explain why measurements of carbon dioxide release in the dark were used to calculate the mean rate of carbon dioxide production of the leaves.
 (iii) Using the information provided in the Table, suggest why plants may not carry out more respiration than non-photosynthetic organisms in the ecosystem.
 (b) Graph in figure below shows the mean rate of respiration in soil under trees and soil not under trees in the same wood. It also shows the mean rate of photosynthesis in the trees. Measurements were taken at different times of the day during the summer.

Page 14 of 43

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

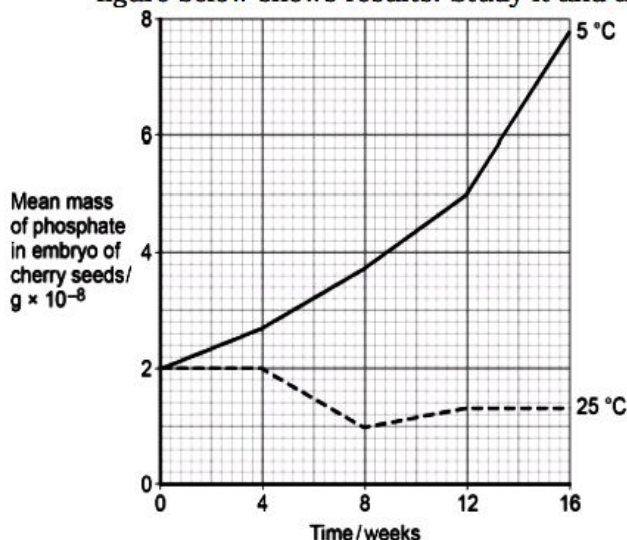


- (i) Compare the changes in the mean rate of respiration in soil under trees and mean rate of respiration in soils not under trees.
 (ii) Suggest an explanation for the difference in the mean rate of respiration in soil under trees and mean rate of respiration in soils not under trees between 06.00 and 12.00.

(iii) Explain the following observations

- Increase in the mean rate of photosynthesis increases the mean rate of respiration in soil under trees
- There is a delay between increase in the mean rate of photosynthesis increases the mean rate of respiration in soil under trees

39. In an experiment to investigate the effect of chilling (exposure to low temperatures) on the mass of phosphate in seeds, cherry seeds were exposed to different temperatures and mean mass of the phosphate in their embryos measured over a period of 16 weeks. The graph in figure below shows results. Study it and answer the questions that follow.



- (a) Compare the changes in the mean mass of phosphate in the embryo of cherry seeds at the two temperatures.
 (b) Account for difference in mean mass of phosphate in the embryo of cherry seeds at the two temperatures.
 (c) Explain how chilling requirements of certain plant species is important in countries with seasonal changes in environmental conditions.
 (d) Apart from chilling, describe other methods of breaking named causes of dormancy in seeds.
 (e) Explain the importance of dormancy to seeds.

40. (a) What are endangered species? (01 mark)
 (b) Describe how organisms become endangered. (08 marks)
 (c) How would you ensure that organisms that are endangered get conserved? (08 marks)
 (d) Suggest reasons why large mammals are more prone to extinction than small mammals. (03 marks)

PROPOSED SOLUTIONS

- 1 (a) (i) An aerofoil is any smooth surface which moves in air at an angle to the air stream:

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

(ii) The wing acts as an aerofoil; in that the leading edge is broader than the trailing edge and the upper side being slightly convex while the lower side slightly concave; so when the wing is held edge-wise in a current of air at a slightly upward angle; angle of attack; the air which flows above the wing is fast flowing and exerts a low pressure; while that which is below the wing is slow moving and exerts a high pressure;

The air pressure gradient between the upper and lower surfaces of the wing provides a lift; which is transmitted to the main trunk of the body: via the coracoid bone; to enable the bird attain height;

(b)(i) **Blood and circulatory system**; high body temperature (39-42°C) permits a greater metabolic rate and so a faster release of energy;

Separate pulmonary and systemic systems provide more oxygen transport;

The blood sugar level is high in order to supply respiratory substrate in order to meet the bird's high energy demands;

Blood pressure is high in order to supply oxygen and glucose more rapidly to muscles;

The heart beat is very rapid up to 10000 beats per minute in extreme cases again to increase blood supply to muscles

(ii) **Nervous system**; the cerebellum is well developed in order to carry out the complex task of coordinating feathers and muscles during flight;

Eyes are well developed with a high concentration of cones in the retina; this permits acute vision; allowing them to spot food from air at a distance;

Eye has a transparent third eyelid-the nictitating membrane which protects the cornea from damage by dust and dirt in air.

(iii) **Digestive system**

A gizzard is present to carry out physical digestion instead of teeth which would have a greater mass; Digestion is rapid to provide adequate respiratory substrate to sustain the high metabolic rate

2. (a) (i) **Inbreeding**

Movement of stamen or stigma when flower gets older so that the stigmatic surface touches the anthers or some part of the flower coated in pollen.

Cleistogamy; flowers do not release pollen onto ripe stigmatic surfaces before the flower buds open thus favoring self-fertilization

Floral structure; some flowers are so arranged that when corolla tube separates from the plant, the anthers rub against the stigma transferring pollen

(ii) **Outbreeding**

Dichogamy; stamen ripen before the stigma and ovule (protandry); or pistil ripens first before the stamens (protogyny);

Unisexual flowers; dioecious plants; which limit inbreeding in flowers

Floral shape; some highly specialized flowers the stigma is exposed to and insect entry:

Incompatibility/ self-sterility; conspicuous petals and sepals;

Scent production to attract pollinators

(b)

Consequences of inbreeding	Consequences of out breeding
----------------------------	------------------------------

It promotes homozygosity i.e. transmission of genotype in the population, resulting into decreased fertility, reduced resistance to disease, thereby reducing evolutionary potential of the species in the long run.	It promotes genetic diversity, resulting into hybrid vigour, causing increased resistance to diseases, high yield, and earlier maturity, thereby providing greater evolutionary potential.
Possible buildup of harmful recessive genes and their expression due to a greater chance of recessive offspring;	Reduce chance of harmful recessive genes expressing themselves

(c)(i) Pollen production does not require much water, while seed formation and fruit ripening require much water.

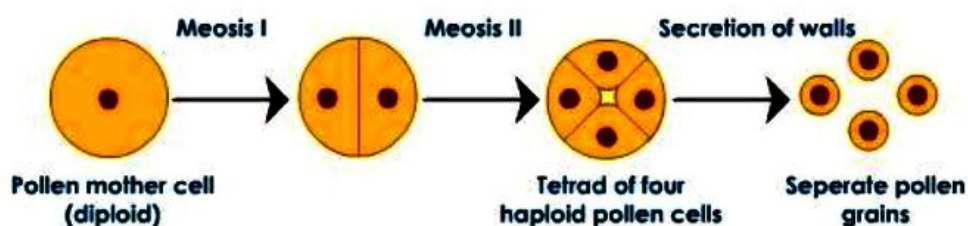
(ii) It may not be possible to have animal pollinators bring in pollen from the same plant species, which would reduce chances of fertilization. It is therefore much easier for wind to bring in pollen from same plant species to increase chances of fertilization

(iii) There is less wastage of gametes in animals than in plants because males and females can move about.

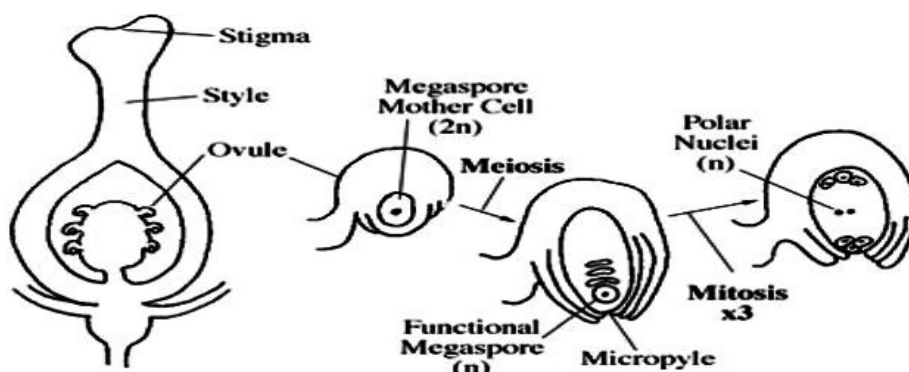
(d) -Half of the individuals in dioecious plants do not produce seeds, whereas all individuals in monoecious plants bear seeds.

-A lot of pollen is wasted in dioecious plants because the male and female plants are not necessarily together.

3. (a)**Gametogenesis in males;** pollen grains develop from diploid; pollen mother cell; within the pollen sacs; of the anther heads; the pollen mother cell undergoes meiosis to form a tetrad of haploid; pollen cells; The nucleus of each cell undergoes mitosis to form generative nucleus; and a tube nucleus; the wall of each cell differentiates into a thick outer sculptured wall called exine and a thinner wall called intine;



Gametogenesis in females; Initially the ovule consists of a mass of cells the nucellus which becomes completely surrounded by two protective integuments; except for a narrow channel at the tip, the micropyle; one cell of the nucleus becomes larger and more conspicuous and forms the embryo sac mother cell; this cell divides meiotically; to give four haploid megaspore cells; the three cells nearest the micropyle degenerate; while the remaining one enlarges to form the embryo sac; whose nucleus divides by mitosis: three times ; giving rise to eight nuclei; and the resultant nuclei migrate to opposite poles; four on each pole. One nucleus from each polar group moves to the center of the embryo sac; the remaining nuclei develop cytoplasm around them and become separated by cells; one cell of three near the micropyle remains as the egg cell; and the others degenerate:



(b) Flowering plants produce seeds and fruits to nourish and protect the embryo plant; and to help in their dispersal:

The male gametes are often carried inside pollen grains to the female parts of the plant; followed by the production of a pollen tube carrying male nuclei to the female gamete; these have reduced their dependence on water for fertilization:

The gametophyte generation has been greatly reduced; since it is poorly adapted to life on land/ requires water for transference of gametes

4. (a) Learning is as adaptive change in-behaviour resulting from post previous experience,

Habituation	learning in which an animal learn by associating a stimulus with either a reward or punishment; when subjected to a continuous / repeated stimulus which is not associated with a reward or punishment
Associative learning	learning in which an animal learns by associating a stimulus with either a reward" or punishment. It involves the conditioned reflex; where a response normally elicited by a specific stimulus is now adapted to be stimulated by a new and different stimulus; e.g. dogs respond to the sound of a bell by pairing it with the presence of food; and trial and error learning; where an animal learns and becomes conditioned by its own behaviour; through experimenting with the environment and being rewarded or punished; e.g. a hungry dog is rewarded with food immediately its jumps onto a chair
Explanatory learning	Learning to solve problems using previous learning experiences related to the problem; e.g. in mice, knowledge of the immediate environment of its borrow may help it escape from a predator;
Imprinting	Learning where by newly born animals become associated with and identifying themselves with another organism or some large object; e.g. goslings tend to follow the first they see when they are born
In sight learning	Immediate comprehension and response to a new situation without trial and error; e.g. chimps stocking boxes to reach food,

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

C(i) Motivation refers to the internal state of the organism which must precede a specific act of behavior; Or which is responsible for temporary reversible changes in the responsiveness of an animal to external stimulation. Motivation thus modifies the nature and extend of any behavior.

(ii) Motivation balances the organism's immediate needs with the ultimate purpose of ensuring survival;

Ensures perpetuation of the species gene pool. E.g most birds forego feeding to ensure successful hatching of young ones to perpetuate the gene pool;

In reproductive behavior it ensures that mating coincides with the optimum time for fertilization and so production of offsprings occurs at the most favorable time of the year for their survival;

(d)(i) Circadian rhythms are biological rhythms with a periodicity of about 24 hours.e.g imming of fruit-flies from pupae while circannual rhythms are biorhythms with a periodicity of one year. e.g. some birds migrate after every one year.

(ii) Synchronizes feeding in predators to time when prey is more vulnerable to capture;

Ensures proper timing of courtship and mating to season of highest food availability to the nursing parent and the growing young one;

Enables migratory organisms to timely avoid unfavorable seasonal conditions, and meet favorable ones where they migrate to;

Synchronizes feeding activity with time of adequate food availability;

5. (a)

Transcription	Translation
Occurs in the nucleus	Occurs in cytoplasm
A polynucleotide chain is formed	A polypeptide chain is formed
Involves assembly of nucleotides	Involves assembly of amino acids
One type of molecule; mRNA is formed	Many different types of proteins/polypeptides are formed
Only few molecules are needed i.e. DNA acting as template and free nucleotides	Many different molecules are needed such as amino acid. tRNA. mRNA, and ribosomes
Enzymes involved are DNA helicase and RNA polymerase	Enzymes involved are amino acyl tRNA synthetase, and peptidyl transferase

(b) When a mRNA synthesized from nucleus reaches the cytoplasm, it attaches to a ribosome: in the smaller subunit; so that at least two codons are covered;

An amino acid is activated by attaching it to a tRNA molecule; to form an aminoacyl-tRNA complex; using energy from ATP a reaction catalyzed by aminoacyl-tRNA synthetase; Usually first activated amino acid is methionine which is brought by the tRNA to the ribosome; the anticodon of tRNA pairs with codon of mRNA; following rules of complementary base pairing; with A pairing with U and G with C A second activated amino acid is also brought to the ribosome; and the ribosome and the ribosome holds the two amino acids until a peptide bond forms between them: catalyzed by peptidyl transferase:

Ribosome then moves forward by one codon; as the first tRNA is released to return to the tRNA pool/ bring more amino acids; The third activated complex is brought to the ribosome and a peptide bond forms between this amino acid and the last amino acid in the growing polypeptide, chain: the ribosome again moves forward; and, the process continues until a stop/non sense codon is reached; when the formed polypeptide peels off the ribosome:

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Translation is the synthesis of a polypeptide, which occurs under the direction of mRNA. During this stage, there is a change in language: The cell must translate the base sequence of an mRNA molecule into the amino acid sequence of a polypeptide.

6.(a)(i) The kidney nephrons contain the ascending and descending loops of Henle; which employ the principle of the hair pin counter current multiplier to conserve and maintain water balance; The ascending limb is impermeable to water but salt is actively transported out of it; the salt is deposited in the surrounding tissue fluid; this produces a region of a particularly high salt concentration; in the deeper parts of the medulla where the collecting duct passes; The descending limb is permeable to water; which is allowed to pass out of it by osmosis: the water is reabsorbed back to the blood stream: some salts are transferred actively from the medulla of the ascending limb to the descending limb; this results into renal fluid becoming more concentrated as it flows down the descending limb; and more dilute as renal fluid flows up the ascending limb;

The ADH makes wall of collecting duct/distal convoluted tubule more permeable to water; water is thus reabsorbed back into the blood stream from the collecting duct resulting in production of a hypertonic urine:

(ii) Insect tissue produce nitrogenous waste in form of potassium urate (K.HU); liberated in blood and taken up by cells lining malpighian tubules; potassium urate reacts with carbon dioxide in the tubule; forming potassium hydrogen carbonate and uric acid: Potassium hydrogen carbonate is reabsorbed back into blood; which provides an osmotic gradient/ increases osmotic pressure of the body fluids; enabling water to be reabsorbed back into blood;

The malpighian tubule has numerous microvilli which increase surface area for water reabsorption: from uric acid deposited in the lumen of the tubule; water is also reabsorbed in the rectal glands giving solid crystals of uric acid:

(b)(i) Is a system that combines exchange of substances/materials between fluids flowing in opposite directions: resulting in an increase in the concentration gradient between the two systems.

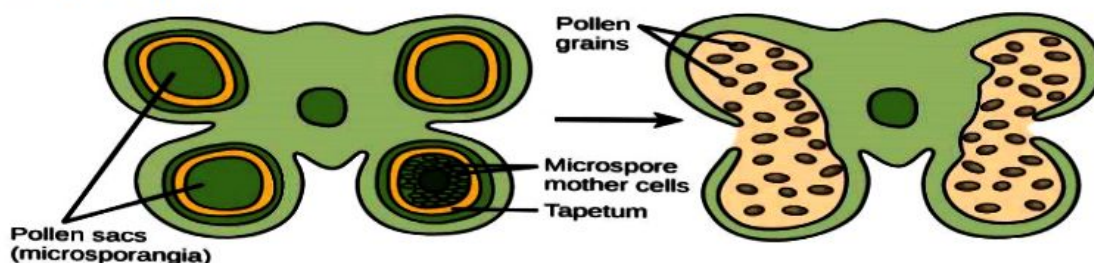
(ii) Counter current flow system in bony fishes; promotes rapid exchange of respiratory gases between blood in a capillary and water passing over the gills;

Counter current flow between the fetal and maternal blood of mammals along the placenta; allows for rapid exchange of materials between the fetal and maternal blood

Counter current heat exchanger between the arterial and venous blood of the feet of birds living in very cold regions for temperature regulation;

Hairpin counter current multiplier along the loops of henle of the kidney in mammals; which creates an osmotic gradient for water reabsorption;

7.(a) An anther consists of four pollen sacs; each pollen sac contains diploid mother cells/ diploid pollen mother cells; pollen grains are surrounded by epidermal layers called tapetum; then vascular bundles at the center; fibrous layers surround the pollen sac/inner and outer walls;



RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

(b)(i)Double fertilization

When the pollen tube gets into contact with the walls of the embryo sac; tube nucleus disintegrates: two male nuclei enter embryo sac; where one fuses with the egg cell; to form a diploid zygote; and the other male nucleus fuses with the two polar nuclei to form a triploid primary endosperm nucleus

(ii)Ovulation in menstrual cycle:

High levels of FSH produced by the anterior pituitary gland: stimulates ovary to secrete the hormone oestrogen; whose high levels in turn stimulates the anterior pituitary gland to secrete LH; LH causes the graafian follicles to reach maturity/ripen and rupture to release the secondary oocyte: into the fallopian tube oviduct a process called ovulation.

(c)

Stamen of Wind pollinated flower	Stamen of Insect pollinated flower
Anthers produce larger quantities of pollen grains/ small light and smooth pollen grains	Anthers produce smaller quantities of pollen grains/ pollen grains are larger /heavier
Anthers are larger	Anthers are smaller
Anthers are loosely attached to the long filament	Anthers are firmly attached to the short filament
Dull colored anthers	Brightly colored anthers

8. (a) During forward movement of the anterior end of the body the anterior circular muscles contract; exerting pressure; on the coelomic fluid; which stretches-the relaxed longitudinal muscles; changing the anterior into longer and thinner segments; this extends the anterior part of the body forward; all the chaetae of the segments except the first and last are retracted: to prevent them from inhibiting forward movement of the anterior segments; As the anterior segments extend forward, the longitudinal muscles of the most posterior segments contract; to make this part swell and grip the substratum firmly to enhance the forward/ anterior segments extend forward; this is aided by protrusion of the chaetae; waves of contraction of the circular muscles followed by contraction of the longitudinal muscles; move along the entire length of the body from the anterior to the posterior; b)A muscle contracts by the-act in filaments sliding; past the myosin filaments in a sarcomere; stimulation of the muscle fiber causes release of Ca^{2+} from the sarcoplasmic reticulum and the T-system; into the sarcoplasm to bind with troponin;

The binding causes change in the shape of troponin; leading to displacement of the regulatory protein; tropomyosin; from binding sites on the actin filament; this enables myosin heads to bridge with actin filaments; and change position causing the actin filaments to be pulled; the filaments slide past the stationary myosin filaments; Hydrolysis of ATP supplies the energy required for movement of myosin heads; Cessation of stimulation causes tropomyosin to re-block the binding sites so that the muscle relaxes:

9(a).Inflation of the lungs at birth reduces the resistance of the pulmonary capillaries to blood (low: blood.... therefore flows in them in preference to the ductus arteriosus; which reduces the pressure in the pulmonary artery; the volume of blood flowing through the body of the baby increases when the umbilical cord is tied; which results in a sudden increase in pressure in the aorta, left ventricle and left atrium; this pressure increase causes the small valves guarding the foramen ovale to close; the lungs' blood supply is boosted when the increased pressure in the aorta forces blood backwards in the ductus arteriosus; the oxygen concentration of blood rises; causing the muscles of the ductus

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

arteriosus to constrict and close it; Blood flow through the liver increases when the muscles in the walls of the ductus venosus constrict and close it;

(b)The amount of yolk inhibits cleavage;

If there is little/no yolk; e.g in amphioxus; the cleavage divisions are symmetrical; resulting in blastomeres/blastula cells of equal size, from divisions of the whole egg/whole egg divides;

If there is a moderate amount of yolk; the whole egg divides:Unevenly/unsymmetrically: with fewer divisions at "the yolky/vegetal pole than at the animal/non yolky pole: resulting into few large cells at the vegetal pole and more smaller cells at the animal pole;

If there is too much yolk/large quantities of yolk; e.g. in chick; the vegetal end does not divide at all/cleavage is confined to a small yolk-free region:

The amount of yolk also affects the cell movement, blastopore shape and the positions of the archenteron during gastrulation;

If there is little/ no yolk, the cell movements are simple; resulting in a circular blastopore: and the archenteron fills the centre in blastula;

More complex cell movements occur if moderate amounts of yolk are present; resulting in a crescent-shaped blastopore; and the archenteron is confined to the animal pole:

Very complex cell movement take place where much yolk exists; and no blastopore forms/ invagination is very difficult (inhibited) primitive streak is formed; the archenteron forms a tiny cavity under the blastodisc:

10.(a) i)Cross pollination leads to formation of varieties within a population; the different varieties when subjected to natural selection may evolve into new species;

Self-pollination involves the maintenance of the same characteristics within a population and does not encourage formation of varieties; and so evolution of new species is not possible;

(ii)Multitudes of species in a given area promote interbreeding; which results into formation of hybrids: with natural selection and isolation mechanisms the may evolve into a new species;

(iii) In artificial selection man exerts a selection pressure; on alleles which determine favorable characteristics; and such alleles are selected for; and its allele frequency is greatly increased in the population: while he eliminates alleles which determine unfavorable/undesirable/disadvantageous characteristics

b)(i)Regular use of antibiotics may induce production of an enzyme that neutralizes/breaks down the antibiotic; rendering them nontoxic; Change the proteins in the bacterial cell wall making antibiotic unable to enter; Development of a protein coat that may not be penetrated by the chemical; Thus evolving into another strain of bacteria hence evolution;

(ii)Sickle cell disease

Normal red blood cells are disk shaped, but in sickle cell disease, the abnormal hemoglobin molecules tend to crystallize, deforming some of the cells into a sickle shape; single copy of the sickle-cell allele reduces the frequency and severity of malaria attacks, especially among young children. The malaria parasite spends part of its life cycle in red blood cells, and the presence of even heterozygous amounts of sickle-cell hemoglobin results in lower parasite densities and hence reduced malaria symptoms. Those with lower parasite densities may have evolved from healthy one hence evolution.

11.(a)(i)The placenta links the mother and fetus when:-Oxygen/ water/ soluble food/ salts; pass from maternal to foetal blood; Carbon dioxide and nitrogenous waste; pass from foetal to maternal blood; Antibodies: pass from maternal to foetal blood;

(ii)Placenta acts as a barrier when; it Prevents mixing of maternal and foetal blood;

Prevents high maternal blood pressure from affecting the foetus directly;

Prevents the passage of pathogens from the mother to the foetus;

Page 22 of 43

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RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Prevents the passage of those maternal hormones that could affect foetal development;

(b)Pregnancy occurs when a blastocyst becomes embedded in the endometrium/implantation; Outer layer of the blastocyst secretes the hormone Human Chorionic gonadotropin (HCG) which maintains. The corpus luteum;

The corpus luteum maintains small steady secretion of estrogen and high level of progesterone; which inhibits follicle stimulating hormone production and offset the menstruating cycle: preventing further development of graafian follicles; the endometrium becomes highly vascularized, to ensure efficient supply nutrients and respiratory gases to the developing embryo; and removal of metabolic wastes via chorionic villi;

The placenta later takes on the role to secrete progesterone and estrogen which together with Human placental lactogen; cause increase in size of mammary glands and enlarging breasts in preparation for lactation;

The uterus also expands to accommodate the developing embryo; in the last three months of pregnancy estrogen increases faster than progesterone then followed by sudden decrease in level of progesterone and estrogen which stimulate the posterior lobe of the pituitary to release oxytocin; which initiates contraction of the uterus; Relaxin hormone also produced by the placenta enables enlargement of the cervix and promotes relaxation of elastic fibers; Prolactin hormone secreted by the posterior lobe of pituitary gland; to stimulate mammary glands secrete milk:

12(a)

Cell division	Nuclear division
Different in plants and animals(Cell plate vs constriction)	Similar in plants and animals
Daughter cells always similar	Daughter cells maybe similar (mitosis) of dissimilar (meiosis)
Duplication of cellorganelles	Duplication of chromosomes
Preceded by nuclear division	Not always followed by cell division(i.e. may form multinucleate cell)

(b)Advantages of meiotic division

There is increased variation of offspring possible as a result of; crossing over during prophase I; Independent assortment of chromosomes during metaphase I;

Formation of haploid gametes, which can then combine in many different pairs to give new genotypes;

Variation provides a range of individuals upon which selection can operate and so lead to evolutionary change;

Disadvantages of meiotic division

The process is complex and complicated mechanisms are needed to ensure effective mating and fertilization;

There are greater risks of mutations occurring, the majority of which are harmful;

Advantages of mitosis

Numbers of offspring can be built up rapidly allowing favourable conditions to be rapidly exploited; By producing identical offsprings, successful genotypes can be cloned and the numbers of these successful genes can be built up in the gene pool;

There is much smaller risk of mutations;

Disadvantages of mitosis

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

There is little if any opportunity for variety; because there is no recombination of DNA; or exchange of genetic material; this implies there is almost no scope for adapting to environmental change and so no potential for evolutionary development;

(c) **Lanky grobe**; Organism A uses meiosis as part of its life cycle. Majority of cells have diploid number of chromosomes (16) but a few cells e.g. in the gamete, have undergone meiosis and so are haploid; with 8 chromosomes. Known examples include most sexually reproducing organisms, e.g. humans

Speckled bobbit; this organism has two separate types; one with the normal complement of chromosomes (38), the other with an additional chromosome, probably the result of non-disjunction during meiosis. The situation occurs in Down's syndrome where children have 47 rather than the usual 46 chromosomes; it's not the case that 39 is the normal number and the other variety has a chromosome missing because all fertile organisms have paired chromosomes; and so the diploid number is even;

Slippery toot; While all organisms have a diploid number which is even, there are infertile hybrids that can arise from cross-breeding between two species; in this case it could be a cross between organisms whose diploid numbers are 16 and 18. The gametes will possess 8 and 9 chromosomes respectively, which on fusing gives an infertile hybrid with 17 chromosomes; An example is the mule ($2n=63$) as a result of a cross between a horse ($2n=60$) and a donkey ($2n=66$)

13(a)(i) Yes the allele for fibrocystic disease is recessive;

Reasons; it skips a generation;

Parents 5 and 6 do not have cystic fibrosis but their son has

(ii) X-chromosome; if the condition was X-linked then male 4 would have inherited the condition from female 1/mother.

Y-chromosome; the condition is not confined to males.

(iii) 4, 5 and 6

(iv) 1 in 4; Since individual 5 and 6 are heterozygous; the probability of having a fibrocystic child in first case was a half ($\frac{1}{2}$) and later it will also be a half ($\frac{1}{2}$). Thus probability = ($\frac{1}{2} \times \frac{1}{2}$) = $\frac{1}{4}$

(v) The cystic fibrosis allele is masked in the heterozygous condition, because the phenotype appears normal;

Also mutations from the normal allele to cystic allele can increase the frequency of cystic fibrosis allele.

(b) Hardy-Weinberg is expressed as; $p^2 + 2pq + q^2 = 1$; where p and q are the respective frequencies of the dominant and recessive alleles;

Genetically this is represented as $MM + 2MN + NN = 1(100\%)$

From the table the number of individuals of each type are;

$\frac{MM}{238}$	$+$	$\frac{MN}{152}$	$+$	$\frac{NN}{26}$	$+$	$\frac{Total}{416}$
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$$M = (238 \times 2) + 152 = 628$$

Therefore the number of each allele is ;

$$N = (26 \times 2) + 152 = 204$$

$$Total = 832$$

i.e. double the number of people in the population because each person has two alleles;

The frequency of M(p) is therefore $\frac{628}{832} = 0.76$,

The frequency of N(q) is therefore $\frac{204}{832} = 0.24$,

The genotype ratios are therefore;

For MM genotype = $p^2 = 0.76 \times 0.76 = 0.58$

For the MN genotype = $2pq = 2 \times 0.76 \times 0.24 = 0.36$

For the NN genotype = $q^2 = 0.24 \times 0.24 = 0.06$

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

$$MM - (0.58 \times 416) = 242$$

The expected numbers of each genotype are therefore; $MN - (0.36 \times 416) = 150$

$$NN - (0.06 \times 416) = 24$$

This ratio of 242:150:24 is very close to the observed ratio of 238:152:26 and the population is therefore in the Hardy-Weinberg equilibrium

14. (a) Secondary growth is due to the activity of lateral meristems; cells in this meristem divide by mitosis and can be differentiated in two types: the vascular cambium: and the cork cambium/phellogen;

Action of the vascular cambium

This contains; fusiform initials (meristemic cells); which divide tangentially forming secondary phloem to the outside and secondary xylem to the inside; much more xylem is formed than the phloem; resulting in the phloem getting gradually pushed out together with the cambium ring;

Ray initials; divide mitotically forming secondary parenchyma: which accumulate to form rays, medullary rays:

Large xylem elements are formed when conditions for fast growth are favorable; and small ones are formed when growth slows; the distinction between these areas of growth form the annual/ growth rings;

Cambium ring is formed; due to the radial divisions of the cambial cells: this increases the circumferences of the cambium layers; to keep pace with the increasing thickness of the stem:

Action of the cork cambium/phellogen;

Beneath the epidermis, the cork cambium cells divide tangentially by mitosis forming the phelloderm/secondary cortex on the inside; and phellem/corky cells on the outside: As the cork cells mature their walls become impregnated with suberin: which renders them impermeable towards; The cells gradually die and lose their living contents: becoming filled with air/resin/ tannins: the older ones fit together around the stem; and may become compressed as the stem increase in girth/may be lost;

The cork cambium also produces lenticels at random intervals; and eventually the stem becomes covered with bark;

(b) Tracheids and xylem vessels are placed end to end; the end walls of the vessels are broken * down during development so that a continuous tube is formed;

The cell walls are impregnated with lignin for support; lignin also increases adhesive force for upward movement of water; and makes vessels impermeable to prevent escape of water; Xylem vessels are hollow; allow water to move freely without obstruction; Being woody; enables them to provide support;

The side walls of vessels and tracheids are perforated with bordered pits to allow lateral water and salt transport;

Tracheids have tapering/ elongated/ sloping end walls containing cellulose; with pits that allow water to pass from one cell to another;

The tubes are long and narrow to increase capillarity force.

The sclerenchyma and much of xylem is dead at maturity: to provide support and strengthen; and to avoid interruption of water movement.

15(a) They are cylindrical in shape; with numerous hepatocytes inside; arranged in rows; radiating from the centre towards the periphery;

The centre of each lobule has branches of hepatic vein(intra-lobular vessel) running longitudinally; and is linked to inter-lobular veins(hepatic artery and hepatic portal vein) by sinusoids; which also form contact and run parallel to hepatocytes; the hepatocytes are surrounded by bile canaliculi; which connect with bile ducts at the edges of each lobule;

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

(b) The proteins are deaminated by the liver; the amino group from the amino acid is removed and converted to urea via the ornithine cycle; and later excreted by the kidney; while the carbohydrate residue is converted into glycogen for storage/respiration;

(d) They destroy worn-out red blood cells/harmful bacteria; by phagocytosis; the plasma membrane of the Kupffer cells invaginates; to form phagocytic vesicles; that engulf the bacteria/germs into vacuoles; releasing hydrolytic enzymes; from their cytoplasm that destroy the bacteria/germs

16(a)-Both contain cell walls;

-Both are multi-cellular

Differences

Fungi	Typical plant
Cellwall made of chitin	Cellwall made up of cellulose
Have multi nucleate cells	Have uninucleate cells
Flatten cristae of mitochondria	Tubular cristae of mitochondria
Are heterotrophic	Are autotrophic
Store food as glycogen	Store food as starch
Non flowering	Flowering (many)

(b)(i) Fungi and algae form a relationship known as lichen; which is mutualistic; in which the algae provides food and oxygen; to fungi through photosynthesis; the fungi has rhizoids that support the algae. The rhizoids also absorb water; respire to produce carbon dioxide; both of which are raw materials for photosynthesis.

(ii) Fungi and plant roots

It's also a mutualistic relationship called mycorrhiza; in which the fungus obtains food; and in turn uses its large network of hyphae to absorb water and nutrients; from the soil; some fungi can digest lignin and cellulose; in the soil and pass on the end products to the roots of the plant; while some fungi offer protection to roots of the plant;

17(a) A sugar cane is a C₄ plant and thus uses C₄ photosynthetic pathway in which Phospho-enol pyruvate (PEP) is the carbon dioxide acceptor; PEP combines with carbon dioxide; a reaction catalyzed by phospho-enol pyruvate carboxylase (PEPCO); to form oxaloacetic acid; which is reduced by NADPH₂; to form malic acid. The malic acid then reacts with Ribulose Biphosphate (RuBP); to form pyruvic acid; and phosphoglyceric acid (PGA); The pyruvic acid is phosphorylated by ATP; to regenerate PEP; while PGA is converted to triose phosphate;

(b)(i) Altitude influences plant distribution by determining the oxygen partial pressure; and environmental temperature; both of which reduce with increase in altitude;

Plants like C₄ and CAM plants are less likely to survive at high altitudes since their photosynthetic enzymes work best at high temperatures; thus their distribution at high altitude is limited; while C₃ plants are more abundant at high altitudes since they photo respire; and their enzymes work efficiently at low temperature;

(ii) Day length

Day length influences distribution of plants by affecting the process of flowering; Long day plants require longer hours of light than the dark to flower and thus are more abundant in temperate regions; where days are longer than nights;

Short day plants require longer hours of dark periods than light and thus are more abundant near the equator where nights are longer.

18(a) Apical dominance refers to growth of apical/terminal bud; and inhibition of lateral bud; due to high concentration of auxin hormone;

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

(ii) Abscission refers to shedding of leaves and fruits; due to breakdown of abscission zone/layer; caused by high concentration of abscisic/ethane/mechanical effect;

(b) Sensitivity of plants to light is brought about by phytochromes; that exist in two inter-convertible forms as phytochrome red; and phytochrome far red; absorption of red light by phytochrome red results into its rapid conversion; into phytochrome far red; which accumulates to induce flowering in long day plants but inhibits flowering in short day plants; absorption of far red light by phytochrome far red results into its slow conversion; to phytochrome red; which accumulates to stimulate flowering in short day plants;

(c) In high concentration, auxins are used as selective weed killers;

Used to induce fruiting in absence of pollination;

Induce root formation in certain cuttings

Used to prevent falling of fruits when applied;

Used as insect killers;

19. (a) Caused by active secretion of salts into the xylem tissue by endodermal cells; lowering water potential of xylem below that of endodermal cells; water is drawn from the neighboring endodermal cells by osmosis into the xylem;

generating a positive hydrostatic pressure/root pressure; only strong enough to force water from the root to the xylem of stems of relative short plants; and slowly transpiring herbaceous plants;

(b) (i) From 06.20hrs to 09.60hrs rate of water movement increases gradually;

From 09.60hrs to 13.60hrs rate of water movement increases rapidly to a peak;

From 13.60hrs to 18.08hrs rate of water movement decreases rapidly;

From 18.08hrs to 24hours rate of water movement decreases gradually;

(ii) Similarities

In both upper branches and trunk, rate of water movement,

Attains a peak;

Increases and then decreases;

Decreases gradually from 1800hrs to 2400hrs

Are equal at 1800hrs

Differences

Rate of water movement in upper branches	Rate of water movement in Trunk
higher peak attained	Lower peak attained
Peak attained earlier	Peak attained later
Higher from 0600hrs to 1800hrs	Lower from 0600hrs to 1800hrs
Lower from 1800hrs to 2400hrs	higher from 1800hrs to 2400hrs
Increases rapidly from 09.60hrs to 13.60hrs	Increases gradually from 09.60hrs to 13.60hrs
Decreases rapidly from 13.60hrs to 1800hrs	Increases gradually from 13.60hrs to 1800hrs

(iii) Rate of water movement peaks earlier in the upper branches because by continuous loss of water through evaporation by the spongy mesophyll cells of leaves in the upper branches into the air spaces; creating a suction force that continuously pulls up water; subsequently increasing rate of water movement in the trunk;

(c) End walls of the vessels are broken down; to give uninterrupted flow of water from roots to the leaves;

Tracheids have tapering endwalls containing cellulose lined with pits that allows water to pass from cell to cell;

Side walls of xylem vessels and tracheids are perforated to allow lateral movement of water;

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Cell walls of the xylem vessels are impregnated with lignin to increase adhesive forces for upward movement of water;

Lignified cells have great tensile strength preventing vessels from buckling when conducting water under tension;

Xylem vessels and tracheids are placed end to end forming a continuous column to allow transportation of water over long distances;

Xylem vessels are hollow allowing free movement of water;

Long and narrow; to increase capillary forces;

20 (a)(i)

(i) Convergent Evolution: Occurs when different organisms that live in similar environments become more alike in appearance and behaviour. The organisms develop analogous structures (same function, but different origins). Examples. Bird's wings and insect 'wings Shark's fins and dolphin's fins	Divergent Evolution. The process by which an ancestral species gives rise to a number of new species that are adapted to different environmental conditions and are less alike. Examples: - Darwin's Finches. Brown bears and polar bears
(ii) Lamarck proposed that organisms could pass on to their offspring traits that were acquired during their lifetime.	Darwin recognized the process by which favorable heritable traits become more common in successive generations of a population and unfavorable heritable traits become less common, due to differential reproduction.

(b)(i)

Fossil is a remain of plants and animals; that lived in the geological past; Fossil study is based on the sedimentary rocks which are arranged layer by layer; Fossils of very primitive organisms are found at the lowest strata; such as the seashell; and many crustaceans', whereas fossils of complex organisms/recent ones; are found at the higher strata; This shows that there has been a slow gradual change from very simple forms to complex forms over a long period of time;

A closer examination of the whole or part of the fossils show resemblance to the modern animals with a few differences or modifications to suit the available niche and all modes of life example: the ancient horse walked on three digits: but the present day horse walks on only one digit; but the other two dangling; and it, had no cusps and ridges in the teeth; but the present horse has cusp and ridges; hence there must have been a slow radial developmental: from simple forms to complex forms;

(ii) Vestigial organ are organs that have lost function during the course of evolution and thus have become greatly reduced in size ;Studies from vestigial structure; all show a common ancestor for example all mammals at one time had a post anal tail: in man only the coccyx has remained and the nictating membrane in man is replaced by the lower eyelid, but in birds and amphibians the nictating membrane forms the lower eyelid:

21.(a) Neurons have myelin sheath; which insulates, axon: making it impermeable to Na⁺ / K⁺: thus depolarization occurs only at nodes of Ranvier; and action potentials therefore have to 'jump/leap' from node to node; thus speeding up transmission speed by salutatory conduction; Axons with large diameter/giant axon; have an increased membrane area; which brings about fast/rapid ion exchange; this reduces resistance; thus faster conduction

(b) Specific example; e.g. pacinian corpuscle / rod / cone / hair cell Correct stimulus: e.g. touch / pressure light / sound

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

For the pacinian corpuscle of the skin; pressure on the skin is transmitted to the corpuscle; if the pressure is great enough, it deforms the corpuscle; and this causes Na^+ channels in the membrane of the corpuscle to open; Na^+ enters cell; K^+ channels open: K^+ leaves cell; this leads to depolarization of the membrane: creating a receptor/generator potential:

When the generator potential is greater than threshold; it leads to action potential /impulses being fired:

If the generator potential is less than threshold only localized depolarization occurs:

(d)This is the additive effect of several excitatory postsynaptic potentials generated in the Postsynaptic membrane; It is distinguished into two forms;

Spatial summation: results if two or more excitatory postsynaptic potentials (EPP) arising simultaneously; at the same time at different regions on the same neurone; produce sufficient depolarization to generate an action potential in postsynaptic membrane

Temporal summation; results from the rapid repeated release of transmitter substance; from several synaptic vesicles by the same synaptic knob: producing individual EPSPs which are so close together that they summate and give rise to an action potential in the postsynaptic neuron;

(e)Presence of receptor sites only on the post-synaptic membrane;

The rate of synthesis of Acetylcholine;

The destruction of acetylcholine by the enzyme after a transmission ensures that no

Depolarization of postsynaptic membrane:

Presence of synaptic vesicles only on one side (pre- synaptic membrane)

22(a)(i)Cause of acid rain; As a result of burning of fuels sulphur dioxide is produced; it goes into the atmosphere and dissolves in the water vapour of the clouds to form sulphuric acid.

Consequences of acid rain

Hydrogen ions bound to soil particles are displaced into runoff water by the SO_4^{2-} from sulphuric acid results into formation of soft exoskeletons, which results into death of invertebrates;

The leaching action of acid rain removes calcium and magnesium ions from soil causing poor formation of middle lamella and chlorophyll in leaves;

Contributes to human respiratory diseases such as bronchitis and asthma;

Can leach toxic metals such as lead and copper from water pipes into drinking water;

Damages statues and buildings;

Decreases atmospheric visibility, mostly because of sulphate particles;

Promotes the growth of acid-loving mosses that can kill trees;

Loss of fish population when the pH lowers below 4.5.

(ii)**Cause of ozone depletion;** Depletion of ozone layer is as a result of discharge chlorofluorocarbons such as aerosol propellants, refrigerator and air conditioner coolants, expanded plastics etc. into the atmosphere; chlorine in these substances then reacts with ozone in the stratosphere thereby reducing the ozone layer while permitting greater penetration of U.V radiations into earth's surface which can eventually lead to skin cancer, global warming;

(b)(i)

- Determination of B.O.D
- Collect the water sample from a pond.
- Carefully fill a BOD bottle with sample water without making air bubbles.
- Add 2ml of manganese sulfate to the BOD bottle carefully by inserting the pipette just below the surface of water. So that you can avoid the formation of air bubbles.
- Add 2 mL of alkali-iodide-azide reagent in the same manner.
- Close the bottle and mix the sample by inverting many times. A brownish cloud will appear in the solution as an indicator of the presence of Oxygen.

Page 29 of 43

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RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

- Allow the brown precipitate to settle out to the bottom.
- Add 2ml of Conc.H₂SO₄ carefully without forming air bubbles.
- Close the bottle and mix the solution well to dissolve the precipitate.
- Keep the bottle in BOD incubator for 5days of incubation.
- After incubation, titrate 50 ml of sample water with 0.025N Sodium thiosulphate to a pale yellow color.
- Then add 2ml of starch solution. So the sample turns blue in color.
- Continue the titration till the sample gets clear and note the readings.
- The concentration of dissolved oxygen in the sample is equivalent to the number of milliliters of titrant used.

(ii)Suspended solids could be measured; this could be done by taking a sample of water and then filtering out particles whose mass can be measured when dry;

pH of water could be assessed using a pH meter;

Assessing turbidity using a colorimeter

Assessing salinity by use of conductivity meter;

(c)Fertilisers containing nitrates are used on crops; ans so when it rains, thy runoff the surfaces of fields into the river;

Also when sewage/ silage effluent enters the river, they result in nitrate enrichment into the river; Increased nitrate content results into growth of plant life of the river; the algae near the surface of the river grow in numbers forming an opaque carpet over the surface; this prevents penetration of light to bottom dwelling plants; Bacteria in water decomposes the sewage releasing more minerals which boost eutrophication;

23 (a)(i)So that carbon dioxide concentration is not a limiting factor; of photosynthesis;

(ii) Iron is the variable;

(iii) To ensure equal amounts of triose phosphate at the start;

(b)Mean concentration of triose phosphate decreases; because iron deficiency less ATP; and reduced NADP is produced; during light dependent stage; thus less glycerate-3-phosphate produced; subsequently decreasing amount Triose phosphate formed;

(c)With less triose phosphate produced; less RUBP; a carbon dioxide acceptor is formed; thus decreasing carbon dioxide fixation;

24(a)(i)

Similarities

Both are vascular tissues

Both possess lubes placed end to end: i.e. the sieve tubes of phloem and the vessels in xylem Tubes in both possess pits (bordered of xylem and the phloem sieve tubes)

Xylem	Phloem
Dead tissue	Living tissue
Tubes are open ended/ have no cross walls	Tubes have cross walls that are perforated to form sieve plates;
Vessels are large/wide	Very small/ narrow
Pits occur in the walls of the tubes/ vessels	Pits occur in the sieve plates

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Dead cells with no nucleus and cytoplasm	Cells contain strands of cytoplasm passing through plasmodesmata
Vessels are deposited with lignin in various patterns	No lignin in cells
Not associated with metabolically active cells	Companion cells are in association with the sieve tube elements for metabolic support
Have sclereid and tracheids -	Lack sclereid and tracheids

(b) Hormones are transported by mass flow in the phloem; as a result of a pressure potential gradient; developed between the sources/ points of manufacture of organic substances; and the sinks/ points of utilization; Photosynthesis takes place at the source/ in mesophyll cells which accumulates sugars/ starch is broken down at the source into simpler sugars; these sugars are absorbed actively by the companion cells; which increases their solute potential/ lowers water potential/ increases osmotic pressure; water from neighboring xylem vessels enters these cells by osmosis: which increases their pressure potential/ hydrostatic pressure/ turgor pressure; this pushes solution through plasmodesmata into sieve tubes;

At the sink/ storage organs, solutes are utilized in respiration/ stored; which decreases their solute potential/ increases water potential/ lowers osmotic pressure; water leaves these cells: decreasing their pressure potential/ hydrostatic pressure;

Solution therefore flows through the sieve tubes; due to a pressure potential gradient/ hydrostatic pressure difference which is the mass flow;

Hormones may also be transported by streaming of cytoplasm; in the trans cellular strands of phloem sieve tubes:

25(a) (i) The foramen ovale allows blood to flow from the right atrium of the heart to the left atrium thereby by-passing the lungs which do not function as a gaseous exchange surface before birth.

(ii) Failure of foramen ovale to close at birth results into deoxygenated blood entering the system causing inability to perform strenuous tasks, breathlessness and a bluish tinge to the skin due to large quantities of deoxygenated blood.

(b)(i) Placenta forms a large surface area for diffusion of nutrients from the maternal blood to the foetal blood such as glucose; amino acid and salts.

(ii) The placenta isolates the foetus from the higher blood pressure of the mother and from direct connection of the two blood systems, excretory materials can easily pass from foetus to mother.

(c)(i) Follicle stimulating hormone

(ii) Between days 21 and 27

Because the egg is released on day 24; when the diameter of the follicle is suddenly reduced; and yet sperm typically live for up to 3 days and so those introduced on day 21 could still be able to fertilize the egg released on day 24; also since the egg takes 3 days to reach the uterus and so could still be fertilized as late as day 27;

(iii) On day 25;

This is because there is a sudden decrease in the size of the follicle/ follicle changes into corpus luteum at this point;

(iv) The corpus luteum does not develop further/ reduces in diameter

(d)(i) A-corpus luteum, B-Primary oocyte, C- Ovum being released from graafian follicle, D-Mature graafian follicle, E – primary follicle.

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

(ii) The primary follicle (E) is present in the ovary at birth. After puberty it may mature into primary oocyte (B); and Later into graafian follicle(D); the ovum from this graafian follicle is released at ovulation(C) and the empty follicle develops into corpus luteum (A)

26(a). Immunity is the ability of the body to resist disease; while auto immunity is a condition where the body mounts an immune response against own components ;(leading to chronic inflammation and tissue damage)

(b) Prevent entry of potential pathogens;

Detects the presence of pathogens by distinguishing it from an animal's own body;

Eliminates the pathogen from the body;

(c) They secrete a layer of mucus that traps the pathogens which are later coughed out or swallowed and killed by the acidic stomach environment;

Beating of cilia in the respiratory tract sweeps them away;

Secretions like wax (and tears) have enzyme lysozyme that digests bacterial cell walls and kills them;

(d) Multiple sclerosis;

Rheumatoid arthritis; type I diabetes;

AIDS

(e)

(a) (i) Average growth rate = $\frac{\text{change in mean mass}}{\text{change in time}}$;

$$= \frac{(67-45)}{(10-0)} \times \frac{22}{10}$$

$$= 2.2 \text{ g/day};$$

(ii) Average growth rate = $\frac{(76-48)}{(50-20)} \times \frac{28}{30} = 0.93 \text{ g/day};$

(b)(i) Similarities

-When no milk is given, mean mass of both group of rats increases; and decreases;

-Both groups of rats have the same mean mass at day 0; and day 46;

--When milk is added, mean mass of both groups of rats increases;

-From 0 to 9th day; and 20th day to 35.5th day; mean mass of both groups of rats increases;

-From 15th day to 18th day; mean mass of both groups of rats increases gradually;

Differences;

Group A rats	Group B rats
From 46 th day to 50 th day, mean mass is lower	From 46 th day to 50 th day, mean mass is higher
From 0 to 9 th day, mean mass increases rapidly	From 0 to 9 th day, mean mass increases gradually
From 9 th day to 11 th day, mean mass increases rapidly	From 9 th day to 11 th day, mean mass remains constant
From 11 th day to 15 th day, and 18 th to 20 th day, mean mass increases rapidly	From 11 th day to 15 th day, and 18 th day to 20 th day, mean mass decreases gradually
From 35.5 th day to 40.5 th day, mean mass decreased rapidly.	From 35.5 th day to 40.5 th day, mean mass increased rapidly.
Attains a maximum mean mass on day 36/earlier	Attains a maximum mean mass on day 50/later;
From 40.5 th day to 50 th day, mean mass decreased gradually.	From 40.5 th day to 50 th day, mean mass increased gradually.
From 0 to 46 th day, mean mass is higher	From 0 to 46 th day, mean mass is lower
Grows faster when milk is added	Grows slower when milk is added

(ii). Mean mass of both groups of rats increases rapidly when they received milk because milk contains lactose sugar; oxidized to provide energy; required for growth; milk provides extra proteins; for growth; extra calcium; for bone and teeth formation; Milk also contains vitamins for proper growth;

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Mean mass of both groups of rats decreased gradually when milk was stopped because the lactose, vitamins and extra proteins needed for growth of different tissue were lacking;

(d). (i) Calcium ions activate the troponin protein; thereby allowing it displace tropomyosin; from the myosin bridge binding site on the thin actin filament; myosin bridge thus attaches to the thin actin filament; forming actomyosin; during muscle contraction.

Concentration of calcium ions when sufficiently high; activates ATP synthetase enzyme; that catalyse ATP hydrolysis; providing energy for muscle contraction;

Calcium ions together with thromboplastin and vitamin K, convert the inactive prothrombin to thrombin; during blood clotting;

Formation of strong bones and teeth;

Calcium ions stimulate the release of neurotransmitter substances; by synaptic vesicles into the synaptic cleft; during impulse transmission along a synapse

(ii). Excess proteins are deaminated in the liver; forming urea; excreted in urine;

27.

(a) Majorly caused by autoimmune destruction of β – cells of the islets of Langerhans in the pancreas; thus insufficient quantities of insulin are secreted;

Also caused by viral infection; and genetic factors;

Its characterized by increased thirst; frequent urination; fatigue; blurred vision; unintended weight loss; bed wetting in children who previously could not wet the bed;

(a) Similarities

In both injected and inhaled insulin,

Peak is attained

Blood plasma concentration increases first, then decreases;

Blood plasma concentration remains constant from 420minutes to 480minutes;

Differences

Inhaled blood insulin concentration	Injected blood insulin concentration
Higher peak attained	Lower peak attained
Peaks earlier	Peaks later
Higher from 0minutes to 156minutes	Lower from 0minutes to 36minutes
Lower from 156minutes to 480minutes	Higher from 156minutes to 480minutes
Increases rapidly to a peak from 0minutes to 42minutes	Increases gradually from 0minutes to 42minutes
Decreases gradually from 42minutes to 90minutes	Increases gradually from 42minutes to 90minutes
Decreases rapidly first the gradually from 90minutes to 240 minutes	Remains almost constant from 90minutes to 240minutes

(c). From 0minutes to 240minutes, increase in injected blood insulin concentration, rapidly decreases blood glucose concentration to a minimum; because transportation of injected insulin to the liver; stimulates liver cells to increase rate of glucose oxidation to release energy; convert excess glucose to glycogen and fats; stored in the liver, muscle and adipose tissue beneath the skin respectively; subsequently lowering the blood glucose concentration;

From 240minutes to 420minutes, decrease in injected blood insulin concentration, gradually increases blood glucose concentration because it lowers the uptake of glucose by cells;

(d) Advantages

Faster response time;

Less chance of infection/contamination;

Applicable for people with needle phobia;

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Disadvantages

Could cause larger swings in blood glucose concentration;

Not long lasting; thus need to be taken frequently;

Possible variability of the dose;

(e). Glucose is a respiratory substrate for cells e.g. brain cells; thus decrease in blood glucose concentration below norm deprives the cells of energy; resulting into fainting/ketosis;

Excess of glucose in blood above norm; increases the osmotic pressure of blood beyond that of the surrounding cells; drawing water from the cells into blood; dehydrating the cells of the body; enzymatic activities are hindered; impairing cellular metabolism;

28.

(a) Is a phenomenon in which auxins from the apical/terminal bud, transported down the shoot directly inhibits growth of lateral buds, causing increase in the length of shoot at the expense of lateral branching.

(b)(i) Auxins inhibit growth of side shoots; thus removal of the terminal buds; inhibits synthesis of auxins; thus concentration of auxins decreases; allowing cell division and thus elongation of side shoots;

(ii)

$$\frac{\text{mean length of side shoots of plants treated with paste alone} - \text{mean length of shoot of plants treated with paste + auxin}}{\text{mean length of shoots of plants treated with paste + auxin}} \times 100$$

% difference in length = $\frac{110-30}{30} \times 100 = 266.7\%$

(iii) similarities

In both side shoots of plants treated with paste alone and plants treated with paste and auxin.

Mean length increases from 8days to 13days of treatment;

Highest mean side shoot length is attained

Differences

Mean length of side shoots of plants treated with paste alone	Mean length of side shoots of plants treated with paste +auxin
Higher from 2days to 13days of treatment	lower from 2days to 13days of treatment
Increases gradually first , then rapidly from 2days to 8days of treatment	Remains constant from 2days to 8days of treatment

(iv) From 2days and 8 days of treatment, mean length of side shoots remains constant/no increase in length occurs because auxins diffused from paste into plant shoots; inhibiting elongation of side shoots;

From 8days to 13days of treatment, mean length of side shoots increases; because little auxin is left; thus cell division and thus elongation of side shoots occur;

(v) Made use of in pruning fruit trees, tea and coffee bushes; where the young shoots are cut off at about one half of their length, resulting into bushy, rather tall plants;

29. (a) Pulse rate increases; because cycling is an energy demanding activity; requiring rapid supply of high amounts of oxygen; and glucose; to the respiring tissue (skeletal muscle) thus heart beats faster; to rapidly pump blood via dilated arterioles leading to skeletal muscles; to supply glucose and oxygen for aerobic respiration generating energy for muscle contraction;

Increased metabolism also accumulates carbon dioxide in blood; which need to be removed from blood; also increasing pulse rate.

(b) During exercise from 0minutes to 32minutes, average lactic acid concentration increases first gradually then rapidly;

After exercise, from 32minutes to 38.4minutes, average lactic acid concentration increases continues to increase rapidly; to a maximum;

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

After exercise, from 38.4minutes to 40minutes, average lactic acid concentration remains constant;
(c) Less anaerobic respiration than aerobic respiration occurs in trained cyclists compared to untrained cyclists; producing less lactic acid during the exercise; as more oxygen is supplied to respiring skeletal muscle tissue; thus requiring less amount of oxygen to oxidize the lactic acid to water; and carbon dioxide; after exercise; allowing faster breakdown of lactic acid;
(d) Pyruvate/ pyruvic acid from glycolysis; accepts hydrogen atoms; from reduced NAD; catalyzed by lactate dehydrogenase enzyme; forming lactic acid; no energy is released or used up;
(e) Lactic acid from anaerobiosis, is transported to liver; and in presence of oxygen; its converted to pyruvate; oxidized to carbon dioxide and water; releasing energy;
In the liver it can also be converted to glycogen; and stored;

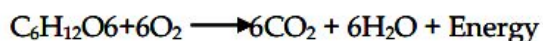
30(a)

- (i) Any organism that is large enough to handle but small enough to be contained within the tube, e.g. woodlouse, maggot, locust, beetle, housefly, earthworm, germinating peas.
- (ii) An individual or group of organisms to be used should be weighed and placed in the specimen tube.

The oil droplet should be positioned about half-way along so that when the bung is inserted - the droplet is forced to the end furthest from the specimen tube.

The position of the droplet should be recorded and timing commenced.

The organism(s) respire(s) according to the equation.



The carbon dioxide produced is absorbed by soda-lime reducing it to a negligible volume.

Any water vapor produced will also be absorbed by soda-lime so that its volume too can be ignored.

The only measureable volume change is therefore due to the intake of oxygen by the organism(s).

The reduction in volume leads to the reduction in pressure within the apparatus.

Atmospheric pressure now exceeds the pressure inside the apparatus and so the droplet is pushed towards the specimen tube.

The time taken for the droplet to move a set distance is recorded and the process is repeated a number of times to allow an average to be calculated.

The actual volume is calculated using the formula for the volume of a cylinder, namely $\pi r^2 h$. Where 'h' is the average distance moved by the droplet and 'r' is the radius of the capillary tube.

The radius of the capillary tube can be determined by finding the internal diameter using a travelling microscope and then halving the value.

The average volume of oxygen consumed should be divided by the average duration of the trials and then by the weight of the organism(s) to give a value of oxygen consumed $\text{min}^{-1}\text{g}^{-1}$.

- (iii)-Use a second set of apparatus but exclude the organism(s).

-All the other conditions should be identical as far as possible and the two experiments should run simultaneously.

-If there is a movement in the control apparatus an adjustment should be made to control the experimental reading.

-For example if the control droplet moves away from the specimen tube the distance moved should be added to the value in the experimental tube -if it moves towards the specimen tube it should be subtracted.

- (b) Any four from the following lists to a maximum of four:

Page 35 of 43

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RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Apparatus not in air tight;

Temperature changes during the experiment (will alter pressure)

Pressure during the experiment;

Soda lime may be exhausted (i.e. has ceased to absorb more carbon dioxide)

Capillary tube may not be horizontal (gravity may move droplet)

(c) Any four of the following four points:

External temperature fluctuation;

Age of the organisms;

Activity of the organisms (i.e. stationary or moving);

Amount of oxygen in the specimen tube;

Light intensity (may affect activity of the animal's photosynthesis in plants)

(d) The movement of the droplet means that the organism(S) have absorbed a of oxygen some 50mm long.

The formula for the volume of volume of a cylinder is $\pi r^2 h$. In case;

$$h = 50\text{mm}$$

$$r = \frac{1.0}{2} = 0.5\text{mm}$$

Therefore volume = $\pi \times (0.5)^2 \times 50$.

To calculate volume the oxygen consumed in one hour we need to multiply by 6 (6x10 min = 1 hour)

To calculate volume the oxygen consumed per gram we need to divide by 4 (total weight = 4g).

The value is therefore: $\frac{\pi \times (0.5)^2 \times 50 \times 6}{4} = 58.9 \text{ mm}^3 \text{ hr}^{-1} \text{ g}^{-1}$

(e)(i) The data indicate that rate of breathing is determined by the concentration of carbon dioxide in, the inspired air (10% of carbon dioxide- high rate; 0.04% carbon dioxide -much lower rate ; 0% lower rate still), because there is no logical in the relationship between the amount of oxygen and the breathing rate (100% oxygen-very low rate).

(ii) During the mouth -to-mouth resuscitation expired air is forced in the patient's lungs. This expired air contains 4% carbon dioxide -100times more in normal atmospheric air.

From the graph an increase in the carbon dioxide is concentration stimulates an increase in the breathing rate and will thus aid recovery.

Pressing the chest wall ventilates runs with air containing only 0.04% carbon dioxide and so it's not as effective at stimulating the patient respiratory rate, and recovery is therefore slower.

(f) The re-breathing of expired air leads to a progressive decrease in the concentration of oxygen and progressive increase in carbon dioxide; The increase in the carbon dioxide concentration will cause a rise in the rate of breathing; The rise in breathing rate will compensate for the failing oxygen level and also act as a warning to the individual as it will cause some distress; Soda lime absorbs carbondioxide and so the breathing rate will not increase and may fall slightly; There will then be no compensatory increase in the amount of oxygen available in the lungs during a given time and no distress warning; The oxygen level/ will continue to fall and the individual, being unaware of the danger may lapse in to unconsciousness and death may follow.

(g) Air contains 20% amount of oxygen and therefore the amount of oxygen available to the athlete at maximum air intake is $\frac{20}{5} = 4\text{dm}^3 \text{ min}^{-1}$.

The athlete uses 0.3dm^3 oxygen each second and therefore in one minute uses $0.3 \times 60 = 18 \text{ dm}^3$.

With an oxygen debt of 14dm^3 the total oxygen capacity for the first minute is $14\text{dm}^3 + 4\text{dm}^3 = 18\text{dm}^3$, and so the athlete can run 1 minute before collapsing.

Running at 5m sec^{-1} the total distance that can be run in 1 minute is $5 \times 60 = 300\text{m}$

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

31.(a) The number of micro-organisms of species A increased rapidly from the first day/zero day up to the sixteenth day; then increased gradually from the fifteenth day up to the seventeenth day; the number of micro-organisms of species A reached a maximum on the nineteenth day.

The number of micro-organisms of species B increased rapidly from the first day/day zero up to the eighth day; where it reached its maximum/peak; then decreased rapidly from the eighth day up to the eighteenth day.

b) Differences of population growth pattern of species A

First set of container / long cylindrical vessel	Second set of container / shallow petri dishes
Population grows faster	Population grows slowly
Maximum population reached is higher	Maximum population reached is lower
Population takes shorter times to reach carrying capacity / stationary phase	Population takes longer to reach carrying capacity / stationary phase

Difference of population growth pattern of species B in

First set of container / long cylindrical vessel	Second set of container / shallow petri dishes
Population of species B grows faster	Population grows slowly
Maximum population reached is higher	Maximum population reached is lower
Population remained constant / level off after maximum	Population declined after maximum
Population reached carrying capacity	Population decline to extinction
Population took a longer time to reach maximum	Population takes shorter time to reach carrying capacity / stationary phase

(c) The first set container was long vessel with larger space: there was vertical separation of species A from species B; (A and B) would be close but separate niches: there was no interspecific competition: Species A and B both reproduced rapidly; until they reached carrying capacity;

In the second set of culture media with shallow petri dishes provided; very small space. Species A and B shared/occupied the same ecological niche/overlapping niches: Still interspecific competition occurred between the two species A and B: Species A was better adapted/has a competitive advantage over species B: after 8 days the population of species B declined to extinction; Species B was less adapted/out competed: this is called the competitive exclusion principle: the reproductive potential of species B reduced due to intense competition.

32. (a)(i) These are non-protein organic substances bonded to the enzyme itself. They transfer atoms or chemical groups from the active site of the enzyme to the other substances

(ii) These are non-protein organic substances which are essential for efficient functioning of certain enzymes but are not bound to the enzyme molecules. They function as carriers by transferring atoms or groups of atoms from one enzyme to another e.g NAD

(iv) These are inorganic ions necessary for the functioning of certain enzymes; Activators work by binding the enzyme and the substrate together; They may be catalytic center of the reaction.

(b) (i) cool and neutral conditions (a)

(ii) Hot and acidic conditions (b)

(c) *Similarities*

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

- Relative enzyme activity with both temperature and PH increase up to maximum rates then decrease;
- Relative enzyme activity with both temperature and PH reaches the maximum rate at 100%;

Differences

- Bacteria that live in cold environment reach their optimum relative enzyme activity at lower temp and higher PH than those in hot environment;
- Bacteria that live in cold have a narrower temperature and PH range of relative enzyme activity than those in hot environment ;
- Before optimum rise in the relative enzyme activity for both bacteria types with PH is rapid while that with temperature is first gradual then rapid
- After optimum decrease in relative enzyme activity with temperature through while with PH for bacteria living in cold is rapid and that in hot falls gradually ;

(d) (i) Affects the enzymes shape/denatures the enzyme by weakening the bonds holding it together; and its reactivity; PH affects the charge on the carboxyl and amino groups in amino acid residue side chains and also the active sites ability to participate in reactions that involve the transfer of protons or electrons

(ii) Temperature affects the folding and movement of an enzyme as well as the kinetic energy of its substrates/ denatures the enzyme so the substrate can no longer fit in the active site;

(e) The enzymes differ in their primary structure; favored by natural selection that best fits them in their distinct environment;

(f) Cellobiose and maltose both have different shapes; thus cellobiose will not fit/bind to/ form enzyme-substrate complex with; active site of amylase;

33.(a) See graph

(b)

Mammal A

From -20°C to 10°C; as temperature increases; the metabolic rate decreases gradually; from maximum to a minimum of 1; From 10°C to 40°C; the rate then remains constant ; From 40°C to 50°C; the rate then increases gradually;

Mammal B

From 5°C to 25°C; as temperature increases; the metabolic rate decreases gradually; from maximum to a minimum of 1.1; From 25°C to 40°C; the rate then remains constant ; From 40°C to 50°C; the rate then increases gradually;

c)(i) Below the low critical temperatures 10°C and 25°C for mammal A and B respectively the physical and behavioral means of regulating body temperature like vasoconstriction, shivering hibernation become inadequate;

The body temperature then falls below normal; the blood reaching the hypothalamus stimulates; the thermo regulatory centre ; which initiates the increase in metabolic rate; in many organs especially the liver. The heat energy generated is distributed around the body by blood to restore the normal body temperature.

(ii) between 15-40°C and 25- 40°C for mammals A and B respectively are the efficiency range of temperature where the physical and behavioral means alone can regulate body temperature.

(iii) Above 40°C;- the high critical temperature; the physical and behavioral means cannot lower the body temperature in both mammals as a result of increasing environmental/body temperature, the **enzymatic activities** causing the body temperature to increase further.

(d) At 5°C; the low lethal temperature; and 50°C the high lethal temperature; the chemical/physiological mechanisms completely break down and mammal dies.

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

(e) Mammal A with a lower low critical temperature and lower low lethal temperature is bigger than mammal B therefore mammal A has a smaller surface area to volume ratio such that at lower environmental conditions it loses less heat than mammal B which has a bigger surface area to volume ratio;

At high environmental temperature conditions mammal A can lose less heat compared to mammal B. Mammal A is therefore better adapted to survive in low temperature conditions, while mammal B survives better in higher environmental conditions;

34.

(a) (i) $\frac{1.0-1.3}{1.3} \times 100; = -23.08\%$

(ii) $\frac{(1.5-0.5)}{0.5} \times 100; = +200\%$

(iii) $\frac{(4.5-1.2)}{1.2} \times 100; +275\%$

(b) Blood flow to the alimentary decreases during exercise because digestion/absorption as large quantities of blood need to be directed to the active skeletal muscles;

Blood flow to skeletal muscles increases during exercise because large amounts of nutrients and oxygen; need to be rapidly supplied to the active skeletal muscles; to generate energy during respiration for muscle contraction;

Blood flow to the skin increases because vessels leading to the skin dilate; caused by increased body temperature generated by increased metabolism; thus need to lose heat through the skin by radiation and convection;

(c)(i) Brain (cell) function has to be constant/cells cannot reduce their energy requirements; should the supply decrease, there would be a disturbance of the brain function; leading to a break down in the complex integration and control of body systems;

(ii) Need to supply more glucose and oxygen; to the muscle to provide energy facilitating the strong/powerful and frequent contractions of the heart muscle to pump blood to the active skeletal muscles;

(d) Skeletal muscles of the limbs contract; squeezing the thin walled veins; forcing blood through them to the heart under high pressure;

Large diameter of the veins; minimizes resistance to blood flow;

Semi lunar valves along their length; prevent back flow of blood ensuring a unidirectional flow of blood;

Inspiratory movements during breathing in reduces the thoracic pressure; draining blood towards the heart;

Gravity allow return of blood from some regions above the heart;

Residual pressure of the heart, usually 100mmHg or less, pulls blood from the veins into the heart;

35.(a) Viruses

(b) (i) D (ii) E (iii) A

(c) The bacteriophage T2 is a virus which attacks the bacterium E.coli; the T2 bacteriophage makes contact with the outer wall of bacterium; using part D attach; when the tail plate at E also gets in contact with cell wall; an enzyme is produced which makes a hole in the cell wall; the tail sheath contracts injecting the viral DNA into the bacterium; once the DNA is inserted into the bacterium; there are two possible consequences; Either the Viral DNA can become incorporated into the host DNA; and replicates in future generation of bacteria without destroying the bacteria a process known as lysogeny; Or the viral DNA can become incorporated into the bacterial DNA and takes

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

over the protein synthesis of the bacterium; making viral proteins; this results in viral enzymes being produced; which are able to synthesize capsomere proteins for the head of the virus; thus new viruses are produced within the bacterium; which finally escapes as the bacterial membrane and cell wall split;

36. (a) (i) Is the contraction of muscles associated with the abdomen; forcing air oxygen in and carbon dioxide out of the spiracles;

(ii) $\frac{(186-42)}{42} \times 100; = 342.8\%$

(iii) Mean rate of abdominal pumping increases during flight because flight is a highly energy demanding activity; thus more oxygen rapidly diffuses into the muscle tissue from the tracheoles; used during aerobic respiration; maintaining a greater concentration gradient;

With high metabolism during flight, accumulation of carbon dioxide in the muscle tissue occurs; thus need to be removed from the body;

(iv) Small insects have a large surface area to volume ratio; allowing efficient diffusion of respiratory gases; Thin body surface provides a short diffusion distance thus rapid diffusion of respiratory gases occur;

(b) (i) 6; /8;

(ii) From 4 minutes to 6 minutes, and 14 minutes to 16 minutes, opening of spiracles rapidly increases oxygen concentration in the tracheoles because relaxation of abdominal muscles which increases abdominal volume while abdominal pressure decreases below atmospheric pressure;

(iii) Spiracle opening is less frequent in terrestrial insect than aquatic insect because there is need to minimize excessive water loss by evaporation via opened spiracle in terrestrial insect;

(iv) During exercise, metabolic activity of the muscles increases; muscles respire anaerobically; lactic acid accumulates; lowering the water potential of the muscle cells below that of the tracheoles; water moves from the tracheoles into the muscle cells by osmosis; more space is created for air/oxygen; more oxygen diffuses into the tracheoles for delivery to the body tissues;

37.

(a)(i) Is a short lasting effect in which the electrical membrane potential of the cell rapidly rises and falls following a threshold stimulus;

(ii) permeability of the membrane to sodium ions increases rapidly to a peak; because on stimulation of the axon membrane, sodium ion gates open rapidly; sodium ions diffuse into the membrane; making inside of the axon less negative/ more positive/ depolarization occurs; subsequently causing more and more sodium ion gates to open; allowing more inward diffusion of sodium ions;

(iii) Potassium ion gates open; sodium ion gates close; potassium ions diffuse out of the axon;

(iv) Sodium ions are actively transported/ pumped out of the axon; while potassium ions are pumped in;

(b)(i) Myelination increases rate of conduction of impulses; because impulses leap from one node to another; Increase in axon diameter increases rate of conduction of impulses; because of less resistance by axon plasma;

(ii) rate of conduction in myelinated neurons of cats is faster than in lizards; because cats are endotherms, capable of maintaining higher body temperature; thus faster rate of diffusion of ions/ faster opening of ion pores/ gates/ channels;

(iii) myelin sheath is destroyed; thus decrease in rate of impulse conduction; as no saltatory conduction occurs;

38.

(a) (i) volume of carbon dioxide given off; in a known area within a set time;

(ii) In the dark, no photosynthesis occurs; which use up the released carbon dioxide;

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

(iii) The results in the table only includes heterotrophic organisms; and does not include animals above the ground or other soil organisms;

The results also do not account for anaerobic respiration;

(b) (i) similarities

In both mean rate of respiration in soil under trees and mean rate of respiration in soils not under trees,

- Peak is attained;
- Remains constant from 24.00 to 06.00;

Differences

mean rate of respiration in soil under trees	mean rate of respiration in soil not under trees
Always higher	Always lower
Higher peak attained	Lower peak attained
Peak attained later	Peak attained earlier
Remains constant from 06.00hrs to 15.00hrs	Increases gradually from 06.00hrs to 15.00hrs
Increases gradually from 15.00hrs to 21.00hrs	Remains constant from 15.00hrs to 21.00hrs

(ii) Mean rate of respiration in soil under trees is higher than in soil not under trees; because there are more roots under tree; that carry out lots of respiration; / more respiratory substrate under trees; thus more organisms carry out respiration;

Mean rate of respiration in soils not under trees increases while that in soil under trees remains constant; because soil not under trees are exposed to direct sunlight; gets warmer; providing a more suitable temperature; for efficient functioning of respiratory enzymes; rate of respiration is thus increased;

(iii)-Photosynthesis produces sugars; transported to roots; used for respiration;

-Time is taken for manufactured sugars during photosynthesis to be transported to the roots;

39.

(a) Similarities

At both 5°C and 25°C, mean mass of phosphate in the embryo of cherry seeds increases from 8 weeks to 12 weeks;

Differences

<u>Mean mass of phosphate at 5°C</u>	<u>Mean mass of phosphate at 25°C</u>
Higher from 0 weeks to 16 weeks	lower from 0 weeks to 16 weeks
Increases from 0 weeks to 4 weeks; and from 12 weeks to 16 weeks	Remains constant from 0 weeks to 4 weeks; and from 12 weeks to 16 weeks
Increases gradually from 4 weeks to 8 weeks	Decreases from 4 weeks to 8 weeks
<u>Increases rapidly from 8 weeks to 12 weeks</u>	<u>Increases gradually from 12 weeks to 16 weeks</u>

(b) From 0 weeks to 16 weeks, mean mass of phosphate at 5°C is higher than at 25°C; because lower temperature, allows phospholipid molecule in cherry seeds to be broken down into phosphates; transported to the embryo;

(c) Since chilling avails the phosphate utilized for growth of embryo of cherry seeds into plants; seeds of certain plant species in countries with seasonal changes in environmental conditions, remain dormant in unfavourable environmental conditions; preventing them from losing all food reserves by simultaneous germination under temporary suitable conditions when the seedling will be wiped out by succeeding period of unfavourable conditions;

(d)

Cause of dormancy	Ways of breaking
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RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Hard and impermeable testa	-microbial breakdown in the soil e.g. by fungi -digestive action by enzymes of mammals, birds -exposure to alternating low and high temperatures; allowing expansion and contraction that cracks the testa -treatment with Sulphuric acid and alcohol that removes a waxy layer of seed coat; facilitating water uptake by imbibition; Physical abrasion of seeds by sand paper
Immature embryo	Allowing an after ripening period;
Germination inhibitors	Treatment of seeds with germination stimulators e.g. Gibberellic acid

(e) Allows seeds to survive adverse conditions e.g. drought
Allows time for dispersal and thus colonization of new habitats
Allows the embryo to grow to full maturity
Ensures longevity of seeds
To remove germination inhibitors

40.(a) Species whose numbers have been greatly reduced and are likely to become extinct: if the factor causing their numbers to decline is not removed.

(b) **Habitat destruction**; through deforestation; bush burning; swamp reclamation: e.g. Uganda's crested crane breeds in wetlands such that if destroyed they are unlikely to breed

Hunting and collection: elephants are hunted for their ivory; rhinos for their horn; python for its skin: threatening their survival:

Some species are massively destroyed due to their being health hazards to man; like mosquitos: can be cleared by spraying with DDT: becoming endangered and later extinct:

Competition between exotic and local breeds; in cattle exotic breeds are preferred because of their high breed vigor: reducing the number of local breeds greatly to near extinction:

Process of natural selection where some species are better adapted to the conditions of the environment than others; those less adapted are likely to reduce in number;

Stiff predation pressure: where the predator has alternative prey the preferred prey will be over consumed leading to its population to decline-Pollution e.g. oil spills: excessive use of fertilizers; due to industrialization resulting into release of dangerous gases

c)

Development of national parks and nature reserves	They may preserve a vulnerable food source, e.g. in China areas of bamboo forest are protected to help conserve the giant panda/In Africa game parks help to conserve endangered species such as the African elephant.
Legal protection	for endangered species - by making it illegal to collect or kill certain species
Commercial farming	The development of farms which produce sought-after goods, e.g. milk farming, deer farming, may produce enough material to satisfy the market and so remove the necessity to kill these animals in the wild
Breeding in zoos and botanical gardens	Endangered species may be bred in the protected environment of a zoo and when numbers have been sufficiently increased they may be reintroduced into the wild
Removal of animals from threatened areas	Organisms in habitats threatened by humans, or by natural disasters such as floods, may be removed and resettled in more secure habitats

RINES GRAND "A" LEVEL BIOLOGY SEMINAR ON SUN 16th JUNE 2019

Control of introduced species	Organisms introduced into a country by humans often require strict control if they are not to outcompete the indigenous species
Ecological study of threatened habitats	Careful analysis of all natural habitats is essential if they are to be managed in a way that permits conservation of a maximum number of species
Pollution control	Measures to control pollution such as smoke emissions, oil spillage, over-use of pesticides, fertilizer run-off, etc. all help to prevent habitat and species destruction
Recycling	The more material that is recycled, the less need there is to obtain that material from natural sources', e.g. through mining. These activities often destroy sensitive habitats, either directly or indirectly through the dumping of waste which is toxic or the development of roads to transport the products
Education	It is of paramount importance to educate people in ways of preventing habitat destruction and encouraging the conservation of organisms

(d)

Large animal's need more food than small ones; so in conditions of food scarcity they are likely to die which reduces their numbers greatly up to extinction;

Problems in achieving fast enough locomotion so that prey fails to escape from predators or predators fail to catch prey: and die due to lack of food:

Food specialization limits range of consumed food; population may be wiped out in case of sudden shortage of food:

Large animals are normally at the end of a food chain so get less energy/accumulate more stable pesticides e.g. DDT