



QUESTIONS FOR 'A' LEVEL BIOLOGY SEMINAR ON SATURDAY 22ND JUNE 2024

1. Figure 1(a) below shows the changes in renal plasma ratio of individual solutes in different parts of the nephron. In figure 1(b) one curve shows changes in the concentration of solutes on administering Antidiuretic hormone (ADH) while another curve shows changes in the concentration of the solutes in the absence of ADH.

Figure 1(a)

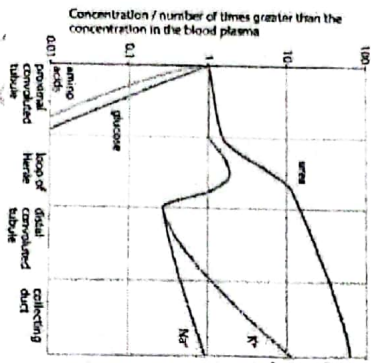
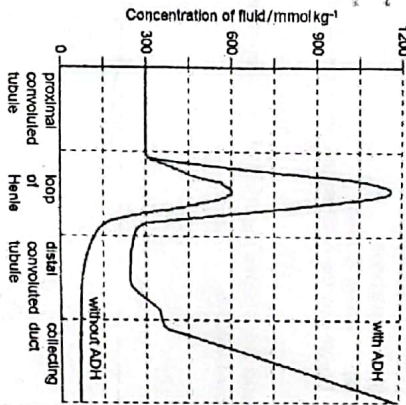


Figure 1(b)



- a) Describe the changes in renal plasma ratio of each solute in different parts of the nephron.
b) Explain the changes you have describe in (a) above.

- c) Pflorizin is a chemical which makes the wall of the tubules impermeable to glucose. Predict how the renal plasma ratio for glucose would change within the nephron. *Mention the means of movement of water i.e. osmosis.*



the proximal convoluted tubule and Loop of Henle if the nephron was treated with Pflorizin. Give reasons for your answer.

- d) Using figure 1(b);
(i) Compare the concentration of solutes in the renal fluid in presence of ADH and in absence of ADH at different regions of the nephron.
(ii) Explain the differences in the concentration of fluid in the different regions of the nephron with and without the presence of ADH.
e) (i) From figure 1(a) above, state two substances absent in the filtrate but present in blood.
(ii) Explain your observation in (d) above

(Trinity College Nublingo)

2. An experiment was carried out to investigate the changes in the levels of phosphoglyceric acid (PGA), Ribulose Bisphosphate (RuBP), and sucrose in the green protist at different light conditions for some time. The green protist was first exposed to light. At 35th minute the lights were switched off. The results of the experiment were presented in the figure 1 below, use it to answer the questions.

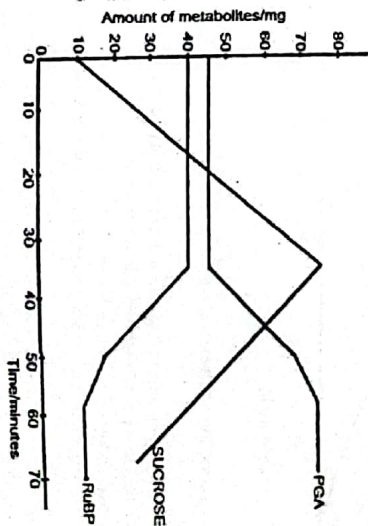


Figure 1.

- (a) Describe the relationship between the amount of RuBP and PGA.
(b) Calculate the rate of increase in the concentration of sucrose
(c) Explain,
(i) The similarities and differences between the amount of PGA and RuBP

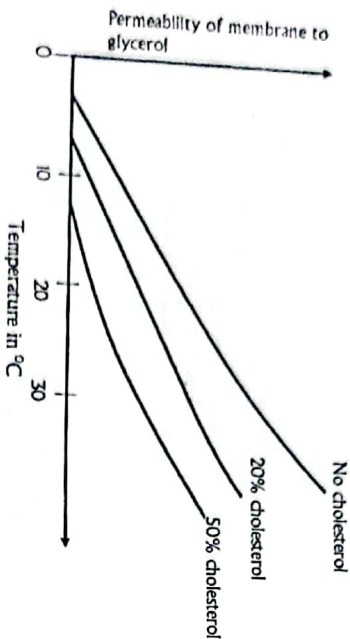


- shown in this experiment.
- How the sucrose is majority translocated passively in the phloem.
 - The decline in the amount of sucrose later during the experiment.

(d) State other organic compounds synthesized, resulting from PCA.

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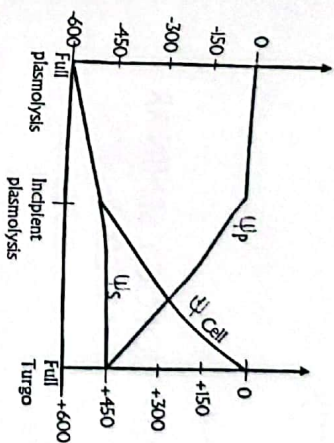
3. The graph below shows the effect of temperature on permeability of membrane to glycerol at different cholesterol amount added to a membrane.



- Explain the effect of temperature on membrane permeability to glycerol without cholesterol.
- Explain the effect of adding cholesterol on membrane permeability to glycerol.
- Suggest reasons why cholesterol was suitable in this experiment.
- Describe the fluid mosaic model of a cell membrane.
- Explain the physiological significance of internal membranes in the eukaryotic cell.

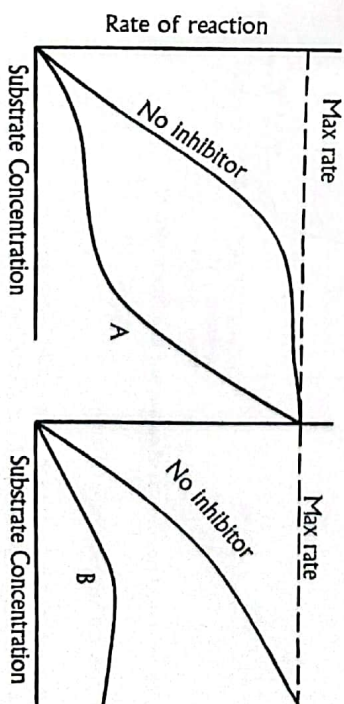
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4. The figure below shows changes in different potentials of a fully plasmolyzed plant cell placed in a hypotonic solution.



- Compare the changes in pressure potential and water potential from full plasmolysis to full turgor.
- Explain the changes in water potential from plasmolysis to full turgor.
- Explain the ecological role of ψ_c plasmolysis.
- Explain why the cellulose cell wall is completely permeable to water.

5. The graph below shows the effect of two different inhibitors on the rate of enzyme controlled reaction.



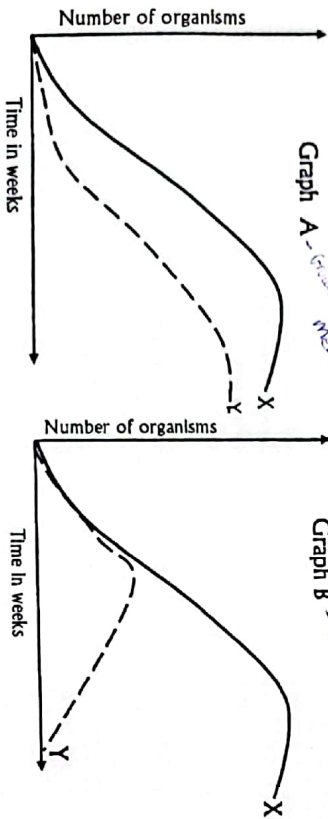
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- With reasons from the graphs, identify each inhibitor A and B.
- Explain the effect of increasing substrate concentration without inhibitors.
 - Explain how substrates are involved in regulation of metabolic pathways.
 - Explain the economic importance of inhibitors in nature.
 - Explain the differences in the effects of inhibitor A and B on enzyme controlled reaction.

St. Elizabeth Nkoore

- Compare the structure of:
 - Cellulose and lignin
 - Polypeptide and polynucleotide
 - Explain why lignin is resistant to hydrolysis and comment on its suitability in the xylem tissues of plants.
 - State the economic importance of:
 - lignin
 - cellulose
- Describe the different nutritional categories of bacteria.
 - Differentiate diploblastic and triploblastic body plan.
 - Explain the evolutionary significance of triploblastic body plan along animal phyla.
 - Explain how a virus is parasitic in nature.

8. The graphs below show biotic interactions of two different species grown in the culture media A and B.



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- Identify and explain each biotic interaction shown in:
 - A
 - B
 - Explain the evolutionary significance of each interaction in:
 - A
 - B
 - Explain how regulating herbivorous animals in the park is negative feedback.
 - State the circumstance under which the above mechanism may fail.
 - Suggest strategies that can control the population size of animals in a game park when natural regulatory mechanism fail.

- What is meant by each of the following:
 - Genetic drift
 - Gene pool
 - Hybrid vigor
 - Explain the effect of increased selection pressure on a population.
 - Explain how each of the following supports evolution:
 - Serological studies
 - Comparative embryology
 - Geographical distribution

- State main features of each of the following:
 - Linkage.
 - Codominance.
 - Heterozygous genotype.

(b) In a cross between pure breeding tomato plant with green, hairless stem and one with a purple, hairy stem. The F₁ seeds were collected and grown. All the resulting F₁ seeds had purple, hairy stems. When the F₁ tomato plants were self-pollinated. The phenotypes and the numbers of the offsprings produced are, Purple, hairy stems = 293. Purple, hairless stem = 15. Green, hairy stem = 12. Green, hairless stem = 98. Using suitable genetic symbols, explain the results of the inheritance described above.

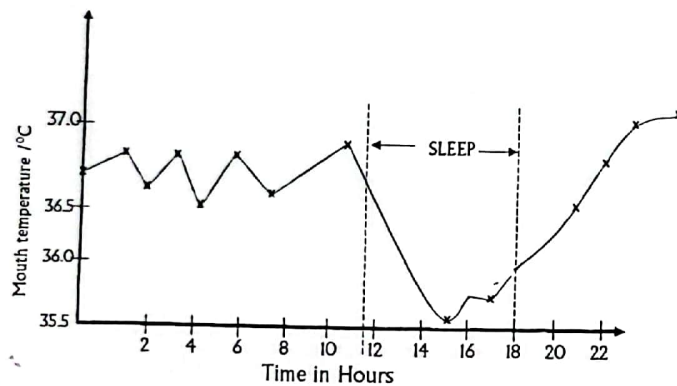
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11. (a) What is the functional importance of double blood supply to the mammalian liver?
 (b) How does the liver assist in the metabolism of energy reserves for use during periods of fasting and starvation.
 (c) Explain how the human liver deal with excess amino acid.
 (d) Explain the cause of yellowing of skin in some newly born babies.
 (e) Explain how diabetic conditions arise in humans.

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12. (a) Give an illustrated account of the structure of;
 (i) Phloem tissue
 (ii) Compact bone tissue
 (b) Describe the process of ossification.
 (c) Explain the evolutionary significance of Bipedals over tetrapods.
 (d) Explain how support is achieved in non woody plants.

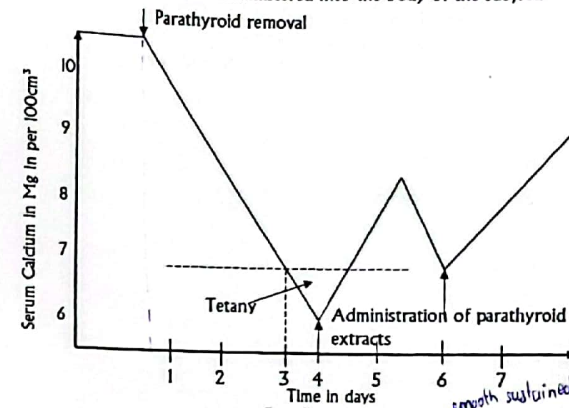
13. The graph below shows daily fluctuations in human body temperature as recorded from the mouth.



- (a) Describe the changes on the graph over a period of 22 hours.
 (b) Explain the changes you have described above.
 (c) Explain the physiological significance of the body temperature to fluctuate within narrow range.
 (d) Suggest the advantages of endotherms over ectotherms.
 (e) State the adaptations of animals to freezing temperatures.

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14. The graph below shows the effects of removing the parathyroids on the concentration of blood calcium ions in the human Serum. On the 4th and 6th day extracts of parathyroids were administered into the body of the subject.



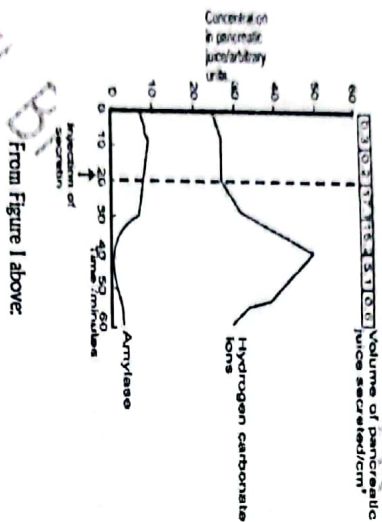
- (a) Describe the effect of parathyroid removal on the concentration of calcium up to the 4th day.
 (b) Explain the fluctuations in Serum Calcium after the 4th day.
 (c) Explain the cause of the development of tetany on the 3rd day.
 (d) Explain why skeletal fractures and breaks are more likely to occur in older women than in men of the same age.
15. Three patients A, B and C were starved for 12 hours and then each was given 50g of glucose in 150cm³ of water. The blood glucose concentration was measured for each patient immediately and then at 30 minutes intervals for a period of 2 ½ hours. The table below summarizes the results from three patients.

Time after ingestion glucose in hours	Blood glucose concentrations in mg per 100cm³		
	A	B	C
0	90	105	240
½	132	165	275
1	155	240	325
1 ½	110	140	310
2	95	120	300
2 ½	90	105	290

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- Plot a graph of these results.
- Comment on and explain the results obtained from all the three patients within the first 30 minutes after ingestion of glucose.
- Comment on results for the three patients in a period 1 to 2 1/2 hours after ingestion of glucose.
- Give an interpretation of the results for each patient with reasons to support your explanation.

16. Figure 1 below show how an injection of secretin affects the secretion of pancreatic juice by the pancreas. Figure 1

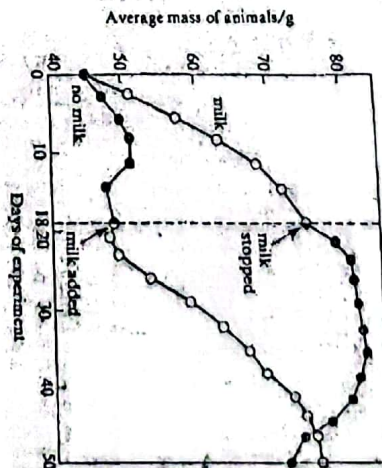


From Figure 1 above:

- Use the graph to describe the effect of secretin on the pancreas.
 - Explain why the concentration of amylase in the pancreatic juice decreased shortly after the injection of secretin.
 - What other digestive secretion is stimulated by secretin.
- Certain types of ulcers are thought of to be made worse by the production of too much acid from the stomach. Doctors have used a number of different methods to treat these ulcers. Suggest how the following treatments might reduce the amount of acid secreted by the stomach:
 - Cutting the vagus nerve to the stomach.

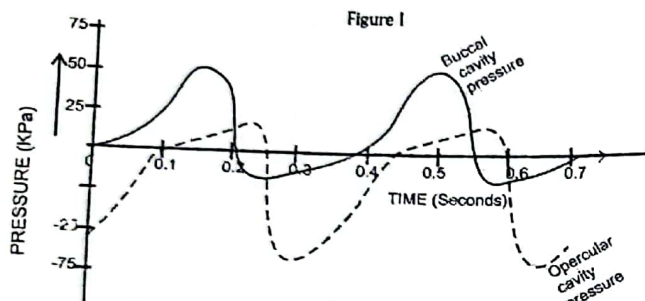
- Giving the patient atropine, a drug which blocks the action of acetylcholine.

Figure 11 below shows the results of an experiment in which two sets of eight young rats were fed on a diet of pure casein, starch, sucrose, lard, inorganic salts and water. The first set received additionally 3 cm³ of milk per day for the first 18 days. On day 18, the extra milk was denied the first set, but given to the second set of rats instead.



From Figure 11 above:

- What hypothesis can you deduce from the graph?
 - Give reasons for your answer in (d) above.
 - Why is a diet of milk inadequate for an adult?
 - Explain the causes of lactose intolerance in some adult individuals.
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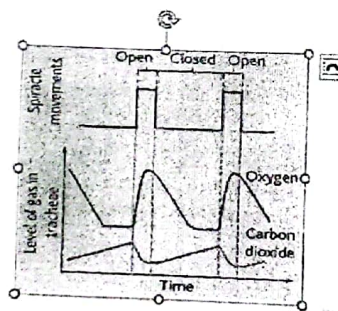


From Figure I:

- Determine the time taken for one complete ventilation cycle.
- Compare pressure changes in the buccal cavity and opercular cavity in the complete cycle.
- Account for the observed changes in pressure in the buccal and opercular cavities from 0.2 seconds to 0.6 seconds
- What is the physiological significance of the difference between the pressure in the buccal and opercular cavities?

Figure II below shows results of an experiment which measured the levels of oxygen and carbon dioxide in the tracheal system of an insect over a period of time. During the experiment, the opening and closing of the insect's spiracles was observed and recorded.

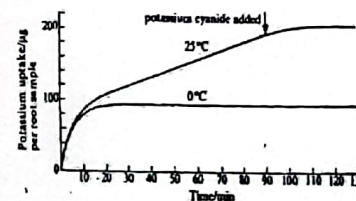
Figure II



- From Figure II:
- Describe the pattern of level of gases in tracheae in relation to spiracle movements.
 - Explain the pattern of level of gases in tracheae in relation to spiracle movements.
 - From the information provided by the graph, suggest the causes of spiracle opening.
 - What is the advantage of the observed spiracle movements to a terrestrial insect?

St. Peters' S.S.

18. The data below was obtained from experiments using plant materials treated as shown below. Figure I shows the uptake of potassium ions in an aerated solution by young cereal roots which had previously been thoroughly washed in pure water. After 90 minutes potassium cyanide was added to the solutions.

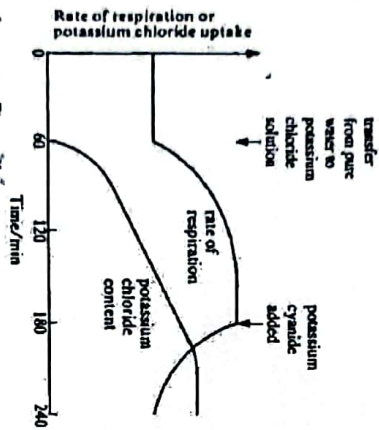


With reference to figure I:

- Compare the change in uptake of potassium ions at 0°C and 25°C.
 - Explain fully the trend of uptake of potassium ions at 0°C.
- Explain why:
 - The same rapid uptake of potassium ions occurred in the first few minutes of the experiment at both temperatures.
 - The uptake of potassium ions at the two temperatures greatly differs for much of the experiment.
 - Potassium cyanide has the effect it does at each temperature.
 - The cereal roots were washed before placing them in a solution containing potassium ions.
 - In a similar experiment, but involving phosphate uptake,

- 16% of the phosphate taken up by barley roots over a short period could be washed out after transferring to pure water again.
- (v) Ions cannot reach the xylem entirely by means of the apoplast pathway.

Figure II Shows the rate of respiration and uptake of potassium chloride by young carrot discs. The carrot discs had previously been thoroughly washed in pure water and transferred to potassium chloride solution after 60 minutes. Potassium cyanide was added to the solution after 180 minutes. Figure II:

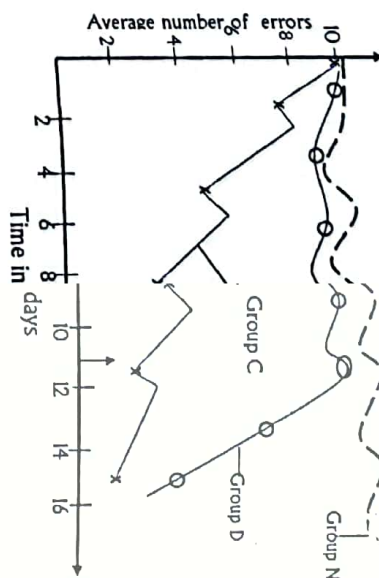


With reference to Figure II:

- (a) Explain the trend in rate of respiration:
- (i) Before addition of potassium cyanide.
- (ii) After addition of potassium cyanide.

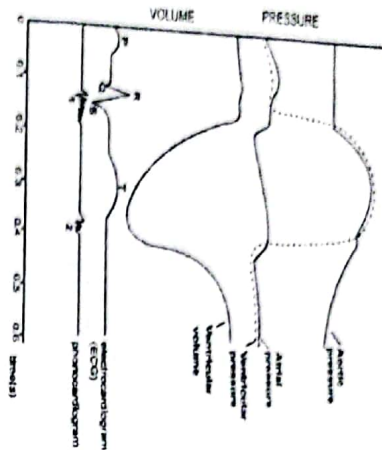
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19. (a) What is meant by the term behavior?
- (b) Explain the ecological significance of different form of associative learning.
- (c) With examples (5) of instinctive behavior explain fully the way in which the response is brought about.
- (d) The graph below shows the number of errors made by three groups of rats C, D and N in a T-maze box. Treatment of each group is shown in a key below. The control was rewarded with food for each day it completed a successful run through the maze.



- (a) Comment on the number of errors made by each group with days of experience in the maize.
- (b) Compare the number of errors in group C and N.
- (c) Account for the above differences.
- (d) State three factors which affect the rate of accuracy in runs made by the rats in the maize.

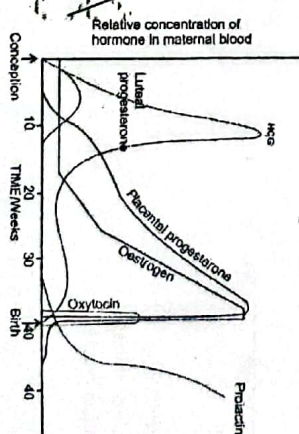
20. The figure below shows the pressure and volume changes that occur during the mammalian cardiac cycle (of a dog). The pressure changes were measured in the left atrium and ventricle, and the aorta. Volume changes were measured for both ventricles. The electrical activity in the heart wall (electrocardiogram) and heart sound (phonocardiogram) as were measured.



- 21.
- Describe the changes in:
 - Atrial pressure.
 - Ventricular pressure.
 - What are the differences in the changes in ventricular pressure and ventricular volume between 0.1 seconds and 0.5 seconds?
 - Explain the effect of the changes in atrial, aortic and ventricular pressures to blood flow during the cardiac cycle.
 - Explain the pattern of:
 - Electrical activity
 - Sounds on the phonocardiogram.
 - Explain how the internal heart structure is related to its functioning.
- The table below shows the difference in percentage saturation of blood with oxygen at varying partial pressure of oxygen between a pregnant woman and that of a fetus developing in her uterus.

Partial pressure of oxygen/mmHg	Percentage saturation of blood with oxygen	
	Mother	Fetus
1.3	8	10
2.7	20	30
3.9	40	60
5.3	65	77
6.6	77	85
8.0	84	90
9.3	90	92
10.6	92	92

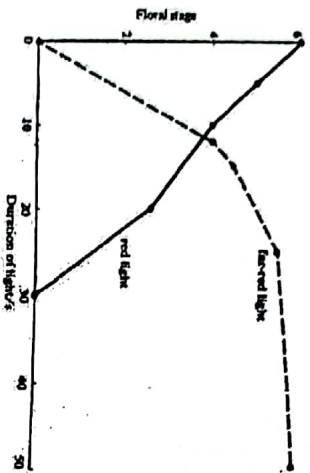
- 22.
- Plot the result in a suitable graphical form.
 - Compare the percentage saturation of blood for the mother and that of the fetus.
 - Suggest why the two curves plotted in (a) (i) are sigmoid.
 - Explain the physiological significance of the position of the fetal curve.
- The figure below shows the changes in the level of some reproductive hormones immediately



- Compare the levels of luteal and placental progesterone.
- Explain the variation in the level of:
 - HCG (Human Chorionic Gonadotrophin) hormone
 - Oestrogen hormone
- What are the effects of the hormone's oxytocin and prolactin towards the end of pregnancy?

23.

A study was carried out to determine the effect of red and far-red light interruptions of long night on the intensity of flowering of a short-day plant. The figure below shows the results obtained from the study.



(b)

In another experiment, three species of the genus of a plant and a hybrid between two of them were tested for their vernalization requirements.

The sample plants of each strain were subjected to different periods of time at 4°C before being returned to their original conditions.

The number of days which elapsed between the end of cold treatment and the onset of flowering were recorded. The results obtained are shown in the table below.

Weeks at 4°C	Number of days between end of cold treatment and the onset of flowering			
	A	B	C	AXB (Hybrid)
0	*	40	25	75
1	160	38	25	65
2	110	36	25	50
4	90	34	25	40
8	35	32	25	32
16	24	28	25	24

KEY: * = did not flower

Use the above information in the table and figure to answer the questions that follow.

- (a) Describe the effect of interruption of the night period on the intensity of flowering of each of the following types of light:

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- (i) Red light
(ii) Far-light
- (b) Give the explanation for the effects described in (a) above.
- (c) Explain how red and far-red light interruptions would have affected the intensity of flowering if they had used a long day plant.
- (d) What was the effect of subjecting the sample plants of each strain to different periods of time at 4°C?
- (e) Explain the results shown in the table
- (f) Predict and explain what would happen if the experiment in the table had been carried out at 1°C
- (g) What is the significance of the two experiments to an agriculturist?

24.

Dissect the specimen A (cockroach) by cutting along the left lateral line of the abdomen. Cut and remove the alimentary canal.

- (a) Describe the structures responsible for food storage and digestion.
- (b) Relate your description above to their function.
- (c) Cut and remove the whole alimentary canal, stretch it on the plain paper provided, measure the length of the fore gut, middle gut followed by the hind gut;
- (i) Record the length of each in millimeters(mm)
- (ii) Calculate the ratio of fore-gut + middle gut and hind gut.
- (iii) Suggest the significance of the ratio calculated above in the life of the animal.
- (d) By further dissection, open the thorax to expose the structures attached on the ventral and dorsal cuticle.
- (i) Draw and label the exposed structures in the upper trunk cavity.
- (ii) Give the significance of the drawn structures above.
25. (a) Dissect the specimen B (Toad) to display the blood vessels;
- (i) Supplying blood to the structures responsible for storage of blood
- (ii) Drain blood from the gonads and kidneys. Describe the structures responsible for storage of blood and relate your description to animal's survival.
- (b) Observe the structure within the upper trunk cavity. Describe the visible structures within the upper trunk cavity.
- (c) Dissect the specimen to displace blood vessels that carry blood to the organs responsible for chemical digestion and drain blood from the upper trunk region. Draw and label your dissection.

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26. You are provided with specimen R (rat) which is freshly killed.

- (a) (i) Examine the structure within the snout of the head and explain how they are adapted to the survival of the organism in its habitat.
 - (ii) Describe the structures of the posterior body trunk region and relate the structural features to their functions.
 - (iii) Observe the dorsal surface of the foot region of the left hind limb. Draw and label the observed structures.
- (b) (i) Dissect to open the abdomen and the thoracic regions. Carefully cut out to remove the gastrointestinal tract with associated blood vessels, diaphragm and thymus gland. Pin the liver lobes anteriorly and turn the heart over and pin it to your left, lift the left lung, turn it to the right. Continue to display structures anterior to the heart, vessels draining blood from structures in the thoracic cavity and urinary structures back to the heart. Draw and label your dissection.

END