UCE BIOLOGY SEMINAR 2019

1. (a) What do you understand by the following terms? (2mks)
(i) Genotype (ii) Phenotype

(b) In a certain plant species, a plant with a green stem was cross-pollinated with one that had a yellow stem and all their offspring had stems with yellow and green stripes. Using suitable genetic symbols work out the genotype and phenotypic ratios if two plants each with yellow and green stripes were cross pollinated. (6mks)

c) Give any two benefits of studying human genetics. (2mks)

2. (a) What is meant by the following ecological terms?

(i) Game cropping (1mk) (ii) Carrying capacity (1mk)

(b) In an ecological study it was observed that organism P feeds on a single tree plant while R feeds on P and Q feeds on R. S feeds on Q. If all letters P, Q, R and S represent living organisms in an eco-system, state an organism that is a:

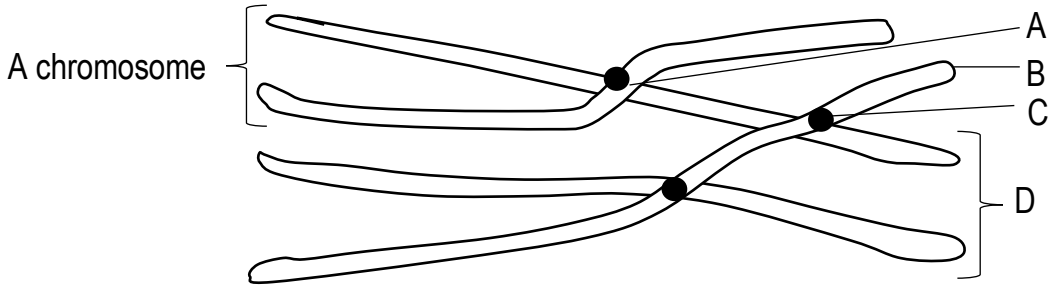
(i) Primary consumer (1mk) (ii) Secondary consumer (1mk) (iii) Tertiary consumer (1mk)

(c)Draw a pyramid of biomass to represent the feeding relationship in (b) above (2mks)

(d) In practical experiment to determine the population of fish in a certain pond, 75 fish were caught marked and released. After 3 days in the second capture, 200 fish were captured but among these 50 had the first mark.

Determine the approximate population of fish in this pond. (2mks)

3. The figure below shows a bivalent at a particular stage of meiosis.



(a) (i) Name the parts labelled; (A- D) (2mks)
(ii) What is a bivalent? (1mk)
(b) At what stage of meiosis is the bivalent formed? Give a reason for your answer. (2mks)

(b) What is the role played by part C? (1mk)
(c) Distinguish between mitosis and meiosis (4mks)

4. (a) Describe the common features of the respiratory surfaces in animals. (4mks)

(b)Explain the adaptations of a respiratory surface in Tilapia. (6mks)

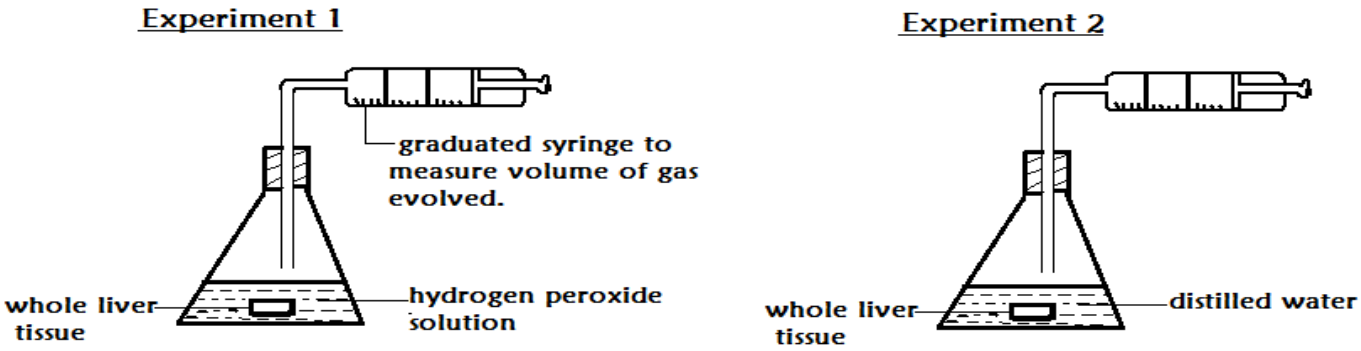
(c) Describe how gaseous exchange in a grasshopper differs from that in a human being. (5mks)

5. (a) What is pollution? (2mks)

(b) Name any four water pollutants and how they affect aquatic life. (8mks)

(c) Give five ways in which water pollution can be controlled. (5mks)

6. The figure below show the effects of an active substance on hydrogen peroxide. Study them carefully and use them to answer the questions that follow.



Experiment 3 is set up as in experiment 1 but with the liver tissue cut into small pieces, then covered with 2cm^3 hydrogen peroxide solution.

(a) State what was observed in experiments 1, 2 and 3.

(i) Experiment 1 (1mk) (ii) Experiment 2 (1mk) (iii) Experiment 3 (1mk)

(b) Explain the observations in experiment 1,2 and 3 stated in (a) above.

(i) Experiment 1 (1mk) (ii) Experiment 2 (1mk) (iii) Experiment 3 (1mk)

(c) (i) Another set up is arranged in the same way as in experiment 1 but using a boiled piece of liver. Explain what would be observed in this set up. (3mks)

(i) Name the gas collected in the graduated syringe. (1mk)

7. (a) Draw and label a transverse section of a stem of a herbaceous dicotyledonous plant (3mks)

(b) State the functions of five of the parts that can be identified in the section (5mks)

(c) Describe how stems are modified to perform other functions other than conducting material within the plant. (7mks)

8. (a) What is meant by the terms:

(i) Co dominance (1mk) (ii) Incomplete dominance (1mk)

(b) In a certain maize plant species, the presence of a recessive gene / allele in the homozygous state causes the seedlings to be white. Such seedlings die at an early stage. In heterozygous state the plants are pale green but grow to maturity.

(i) If a pale green maize plant was crossed with a normal green plant, what would be the genotypic ratio of the F1 generation? Show your working (5mks)

(ii) Work out the phenotypic ratio of the plants that would grow to maturity from seeds obtained by selfing the pale green maize plants from the F1 generation. (4mks)

(c) What is the importance of genetics to man? (4mks)

9. The table below shows the changes in the percentage composition of two substances in the glomerular filtrate as they move along the nephron from the Bowman's capsule to the collecting ducts.

Distance along the nephron (arbitrary units)	0.1	0.2	0.4	0.5	0.6	0.7	0.8
Percentage of glucose	2.5	2.0	1.2	0	0	0	0
Percentage of urea	1.5	1.8	2.6	3.0	3.8	4.0	4.0

(a) On a graph paper, draw a graph to represent the above data. (8mks)

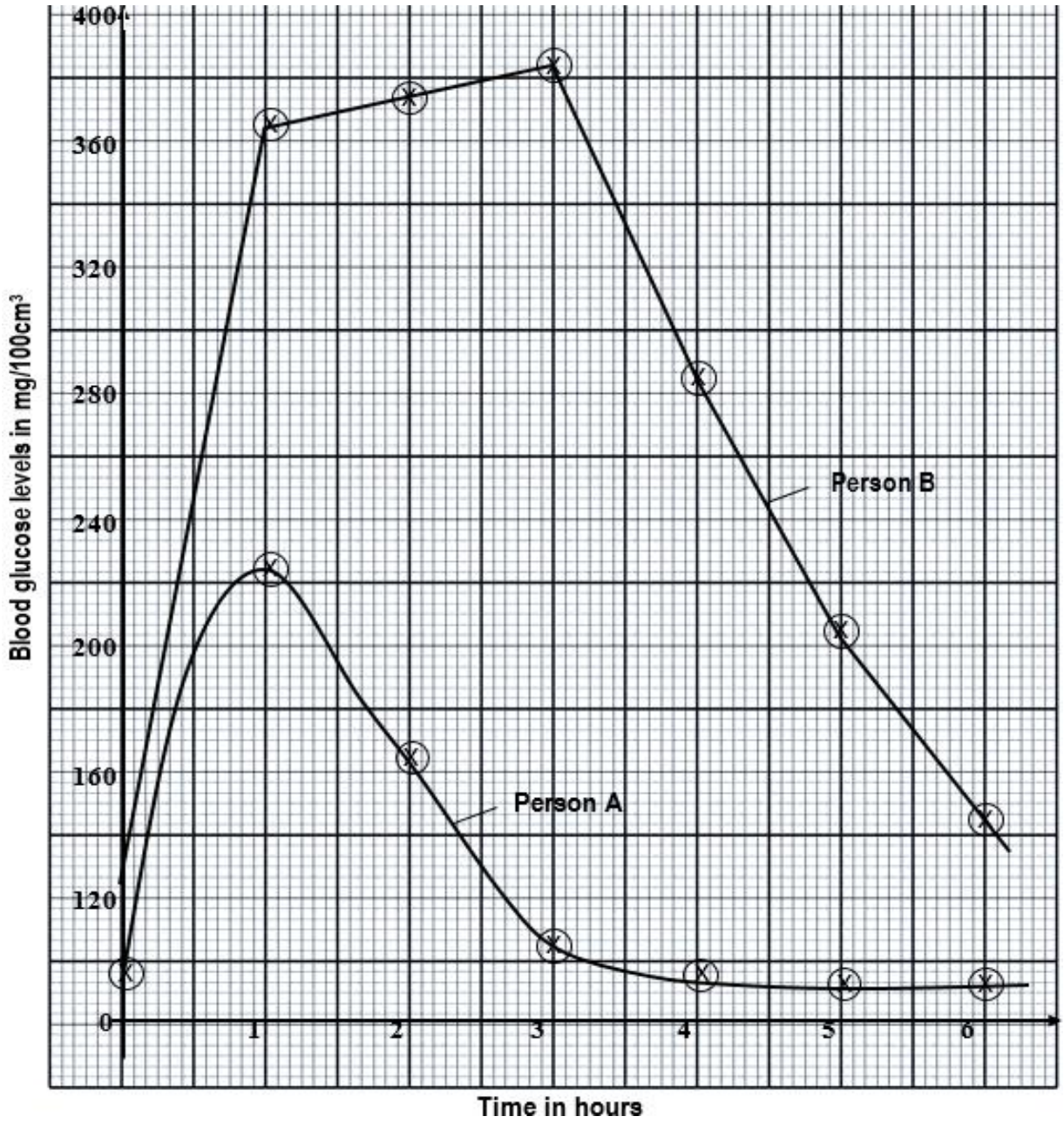
(b) i) Using your graphs, describe the percentage changes in the two components above along the nephrons. (5mks)

(ii) Explain the trend shown by each graph. (3mks)

(c) (i) Outline any two factors that favour the process of ultra-filtration to occur successfully in one part of the kidney nephron. (2mks)

(ii) From the table above, state two functions of the kidneys nephron. Give reasons for your answer. (2mks)

10. In an investigation, two persons **A** and **B** drunk the same amount of glucose solution. Their blood sugar levels were determined immediately and thereafter at intervals of one hour for the next six hours. The results obtained are shown on the graphs below.



(a) Describe the trends of the graph.

(i) For person **A**. (3mks) (ii) For person **B** (3mks)

(b) Give reasons for the trends of blood glucose levels in person A between;

(i) O and 1 hour (4 mks) (ii) 1 and 4 hours. (4 mks)

(c) Suggest a reason for the high glucose level in person B. (3mks)

(d) What are the biological importance of maintaining a relatively constant sugar level in human body? (4mks)

11. (a) Briefly describe the role of each one of the following during gaseous exchange in bony fish.
(i) The mouth (3mks) (ii) The buccal cavity (5mks)

(b) Compare the process of inhalation with that of exhalation in man. (7mks)

12. (a) What are the dangers of destroying forests in Uganda? (7mks)

(b) Suggest ways of conserving forests in Uganda. (8mks)

13. (a) Describe the structure of the different types of bird's feathers, stating the function of each type. (8mks)

(b) What factors contribute to bird's ability to fly? (7mks)

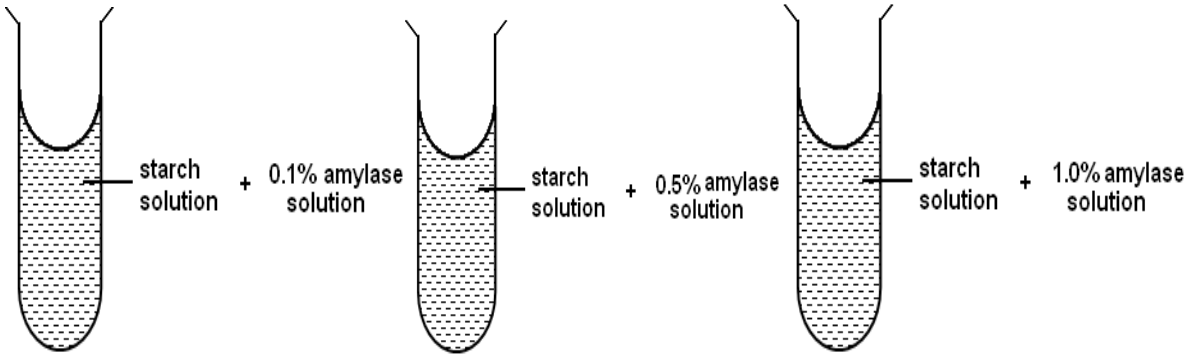
14. (a) Describe the digestive processes which take place in the ileum (5mks)

(b) Explain the importance of bile digestion (4mks)

(c) Explain what happens to the end products of digestion when they leave the small intestines (6mks)

15. An experiment to investigate the effect of an active substance on a food substrate was set up as shown in the figures below. The three setups were left to stand for 5 minutes when the temperature was maintained at 35°C.

Test tube **A** Test tube **B** Test tube **C**



(a) After 5 minutes,1cm³ of the contents in each test tube was added to a separate test tube and 1cm³ of Benedict's solution was added and the mixture boiled.

(i) Complete the table below using the observation made. (3 marks)

Test tube	Observation	Deduction
A	Turbid solution turned to blue solution to green solution	
B	Turbid solution turned to blue solution to green solution to yellow precipitate	
C	Turbid solution turned to blue solution to green solution to yellow precipitate to orange precipitate	

(ii) Explain the results in: (3 marks)
Test tube **A**. Test tube **B**. Test tube **C**.

(b) What is being investigated in the experiment? (1mk)

(c) How do enzymes differ from catalysts? (3mks)

16. (a) What is the advantage of being an endotherm? (6mks)
(b) Explain the adaptations of animals to living in hot climates. (9mks)

17. (a) What is self-pollination? (2mks)
(b) How is self - pollination naturally prevented in plants? (4mks)
(c) Describe the features of a flower that favour pollination by insects. (9mks)

18. (a) What is meant by the term placentation? (1mk)
(b) With the aid of diagrams, describe the following types of placentation in fruits. (14mks)
(i) Marginal placentation (iii) Free central placentation
(ii) Axile placentation (iv) Parietal placentation

19. (a) Describe an experiment to show that a leaf exposed to sunlight manufactures starch for the plant. (11mks)
(b) State any four modifications of leaves for any other functions (4mks)

20. (a) Describe the digestive processes which take place in the ileum (5mks)
(b) Explain the importance of bile digestion (4mks)
(c) Explain what happens to the end products of digestion when they leave the small intestines (6mks)

21. The data below shows the number if bubbles produced per minute at 15^0C and 37^0C from an aquatic plant when it was exposed to light from a 100W bulb at several distances from the set-up of the plant in water. The bubbles produced are taken as the rate of photosynthesis. Study it carefully and use it to answer questions that follow.

Distance of the bulb from the plant/cm	5	10	20	30	40	50	55	60	65
No. of bubbles produced at 15^0C	400	360	290	220	160	100	70	50	30
No. of bubbles produced at 37^0C	810	750	630	500	390	310	270	200	175

(a) (i) Plot a graph of number of bubbles produced and the distance of bulb from the plant using the same axes (10mks)
(i) What was the experiment intended to demonstrate? (1mk)
(ii) Describe the shape of the graph at 37^0C from your results (2mks)
(b) Explain the difference in the number of bubbles produced by the same plant at 15^0C and 37^0 C (3mks)
(c) A part from the factors given, state other factors that would affect the rate of photosynthesis in an aquatic plant. (2mks)
(d) (i) State the significance of photosynthesis in nature (3mks)

22. (a) Complete the table below concerning blood transfusion in man (4marks)

Blood group	Can donate to	Can receive from
A		
B		
AB		
O		

(b) What is the advantage of having blood group AB? (1mk)
(c) (i) What is the main disadvantage of having blood group O? (2mks)
(ii) What do you understand by agglutination of red blood cells? (2mks)
(d) Briefly explain the role of antibodies in the defense of the body against diseases. (2mks)

23. (a) What is germination? (1mk)
(b) List the external condition necessary for germination to take place (2mks)
(c) During the germination of a cereal, the dry weight of the endosperm, embryo and total dry weight were determined at a 2 days intervals.
The results are shown in the table below.

Time after planting (days)	Dry weight of the endosperm (mg)	Dry weight of the embryo (mg)	Total weight of the cereal (mg)
0	43	2	
2	40	2	
4	33	7	
6	20	17	
8	10	25	
10	6	33	

(i) Complete the table by calculating the total dry weight of the cereal after every two – day's interval. (3mks)

(ii) Using the same axes, plot a graph of dry weight of endosperm and embryo against time. (6mks)

(c) From the graph you have plotted in b (ii) above, determine;

(i) The dry weight of the endosperm on day 5 and on day 7 (1mk)

(ii) The dry weight of the embryo on day 3 and on day 7 (1mk)

(d) Explain why the dry weight of the;

(i) Endosperm decreased between day 0 and day 10 (2mks)

(ii) Embryo increased between day 0 and day 10 (2mks)

(iii) Total dry weight decreased between day 0 and day 8 (1mk)

(iv) Total dry weight increased after day 8 (1mk)

24. In a certain ecosystem, hawks feed on snakes, toads and chicken. The snakes feed on toads, lizards and chicken while these feed on worms, termites and grasshoppers. Worms, termites and grasshoppers feed on green plants.

(a) (i) Using a suitable illustration, show the feeding relationship between all the organisms in this ecosystem. (3mks)

(ii) Construct a food chain to show the feeding relationship between, snakes, worms, toads, hawks and green plants (2mks)

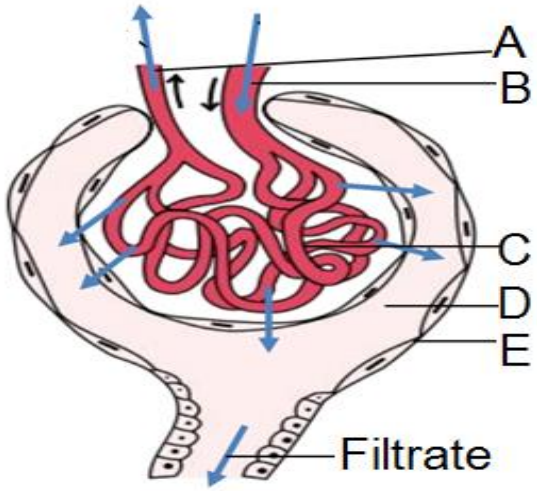
(iii) For the food chain in (a) (ii) above, construct a pyramid of numbers to represent the feeding relationship. (2mks)

(b) (i) What trophic levels do the following organisms occupy in this ecosystem? (2mks)

- Chicken
- termite
- green plants

(ii) Why are trophic levels in a food chain normally **not** more than five? (1mk)

25. The diagram below shows part of the human kidney nephron.



(a) Name the parts labelled A – D

(b) (i)Suggest the name of the process that leads to the formation of the filtrate in the diagram above (1mk)

(ii) How is the structure above suited to carry out the process mentioned in b(i) above (4mks)

(c) State three differences in the composition of blood flowing through vessels A and B (3mks)

26. A maize plant that was tall was crossed with another one which was dwarf. All the offspring of F_1 generation were of medium height.
    (a) Why were all the offspring of F1 generation of medium height? (4mks)
    Show how you arrive at the answer
    (b) Work out the phenotypic ratio of the offspring of;
    (i) Medium height plants if self-pollinated (3mks)
    (ii) Medium height plants if cross pollinated with tall plants (3mks)
27. (a) Differentiate between fertilization and implantation (4mks)
    (b) Explain the advantages of internal fertilization (6mks)
    (c) Explain how a placenta is adapted to carry out its functions (5mks)

28. a) Distinguish between vegetative propagation and sexual reproduction. (4mks)
    b) Describe the process of sexual reproduction in spirogyra. (6mks)
    c) Outline five disadvantages of vegetative propagative over sexual reproduction. (5mks)
29. An experiment was carried out to investigate the effect of temperature on the rate of sucrose digestion by an enzyme.

    Nine test tubes labelled 1-9, each containing an equal volume of enzyme solution, were placed in separate water baths, each maintained at a different temperature respectively for the entire duration of the experiment. Nine other test tubes each containing an equal volume of sucrose solution were placed in other nine water baths. After 15 minutes, the contents of each pair of test tubes were mixed into one test tube and the mixtures returned in their separate water baths.

    The rate of reaction was determined by finding the mass of products formed per minute. The results were as shown in the table below.

Temperature (^{0}C)	5	15	25	30	35	40	45	50	60
Rate of reaction (mg/min)	0.5	1.2	2.4	3.1	3.7	4.1	3.7	3.1	0.0

    (a) Using the information in the table, present the results in a suitable graphical form. (6mks)
    (b) Why were the enzyme and sucrose solutions separately placed in each water bath,15 minutes before mixing (1mk)
    (c) At what temperature range is the enzyme most active? (1mk)
    (d) Suggest a reason for the results at 60^{o}C. (1mk)
    (e) If the temperature of the mixture previously kept at 60^{o}C was lowered to 35^{o}C. What would you expect the results to be? Explain your answer. (2mks)
    (f) (i) What are the end products of digestion of sucrose? (1mk)
    (ii) Describe the chemical test you would carry out to show the presence of the products indicated above. (3mks)
    (g) Name the enzyme involved in hydrolysis of sucrose (1mk)
    (h) State four factors other than temperature that affect the rate of enzyme controlled reaction. (4mks)
30. (a) Outline the feature on a grass hopper that qualifies it to be an insect. (3mks)

    (b) What are the adaptations of grasshoppers to terrestrial life? (8mks)

    (c) Explain why grass hoppers swam in rainy seasons (4mks)

31. (a) Draw and label a transverse section of a stem of a herbaceous dicotyledonous plant (3mks)
    (b) State the functions of five of the parts that can be identified in the section (5mks)
    (c) Describe how stems are modified to perform other functions other than conducting material within the plant.

32. A class of students at a certain school, used a model to demonstrate the effect of sweating and insulation on the human body temperature. Three round bottomed flasks A, B and C were filled with hot water. The temperature of water in the flask was taken at the start of the experiment and then at 10 minutes interval. The surface of the flask A was continuously wiped with a piece cotton wool soaked in ethanol.
Flask C was covered all round with dry cotton wool. The results obtained are as shown in the table below.

Time in minutes	Temperature in flasks (^{0}C)		
	A	B	C
0	85	85	85
10	50	68	78
20	35	56	75
30	29	45	72
40	25	40	71
50	21	36	70
60	19	33	69

(a) On the same axes, plot graphs of temperature of water in the flasks against time (8mks)
(b) (i) At what rate was the water cooling in flask A? (2mks)
(ii) Account for the rate of cooling in flask A? (3mks)
(c) (i) Why was flask B included in the set up? (1mk)
(ii) State two processes of heat loss in flask B
(d) Account for the rate cooling in flask C (2mks)
(e) What would the insulation used in flask C be comparable to in (1mk)
(i) Birds (ii) Mammals
(f) Name the structure in the human body that detect;
(i) External temperature changes (ii) Internal temperature changes

33. An experiment was done with a protozoa living in the sea. The animal forms a contractile vacuole. The number of times the contractile vacuole forms and discharged in a period of 10minutes was recorded when the protozoa was placed in sea water with varying concentrations.

Number of times the vacuole forms	13	11	10	8	5	4	3	2	1	0
Percentage of salt in sea water	1.0	1.3	1.5	1.9	2.3	2.7	3.4	3.9	4.7	4.9

(a) Using the results in the table above, draw a graph showing the variation of number of times the vacuole forms in ten minutes with percentage of salt in sea water. (9mks)
(b) Using the graph you have drawn in (a), determine the percentage of salt in sea water which enables the protozoan to form six (6) vacuoles in 10 minutes. (1mk)
(c) State the relationship present between the concentration of sea water and the number of times vacuoles from in 10 minutes. (2mks)
Explain the relationship stated in (c) above (4mks)
(d) Explain what would happen to the protozoan if it was place in sea water whose percentage of salt was 6.5 for 1hour. (2mks)
(e) State any two substances the contractile vacuole removes from a protozoan (2mks)

To be continued……