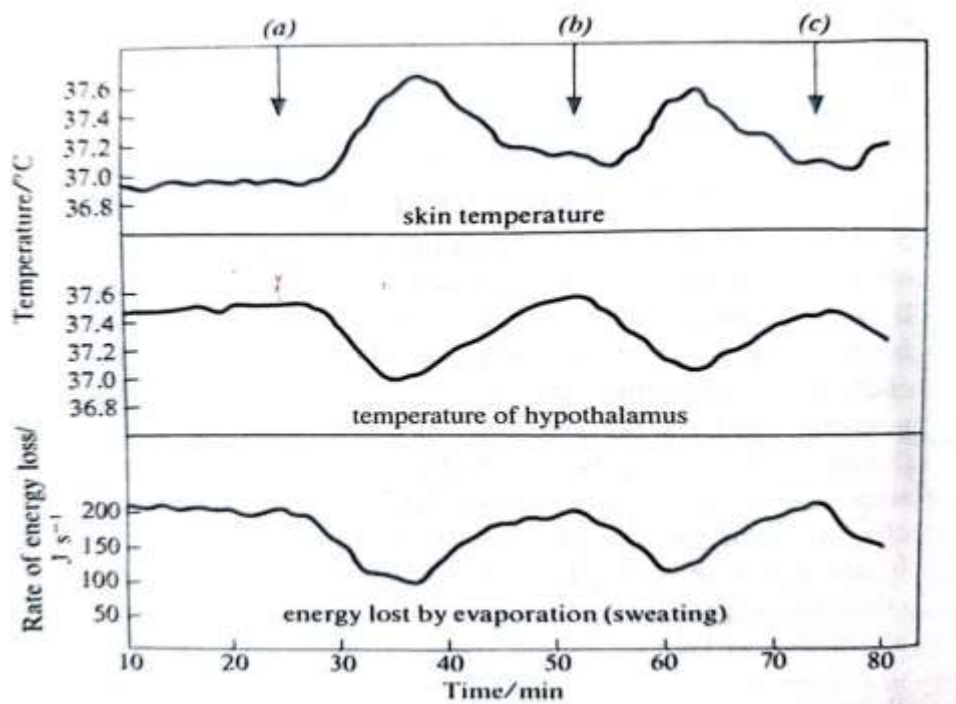


**KIBULI S. S. A-LEVEL BIOLOGY SEMINAR,
17th SEPTEMBER 2022**

1. The graphs below show the relationship between skin temperature, temperature of the hypothalamus and the rate of evaporation for a human in a warm chamber maintained at 45 °C. Iced water was swallowed at points labelled (a), (b) and (c).



- (a) Describe the relationship between the temperature of the hypothalamus and the rate of sweating.
- (b) Between the first two intervals iced water intake, explain why there are changes
 - (i) in the temperature of the hypothalamus and the skin.
 - (ii) rate of energy loss by evaporation.
- (c) Why was iced water not given until 20 minutes after the start of the experiment?
- (d) The onset of a fever is often accompanied by shivering and a feeling of cold known as chill.
 - (i) Explain these symptoms in terms of the mechanism of control of body temperature.
 - (ii) What is the significance of this response to the body?
- (e)
 - (i) Outline the different ways in which plants avoid excess heat.
 - (ii) Explain why plants suffer physiological damage when exposed to high temperature and high humidity.

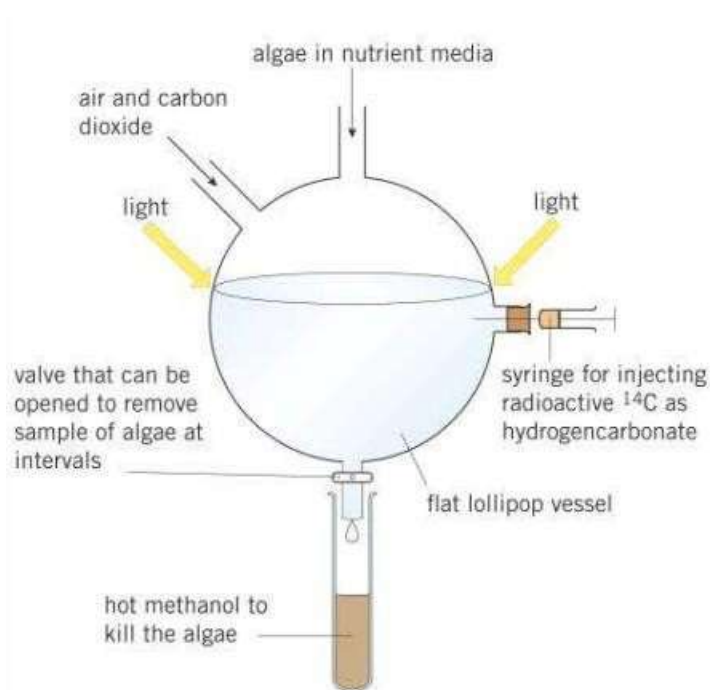
KIBULI SS

- 2(a) Compare cell-mediated response and humoral response.
- (b) Describe the evidence that show that the thymus gland is important in the development of the immune response.
- (c) Explain how the immune response is regulated.
- (d) Explain the colonial selection theory.
- (e) Explain why we do not produce antibodies against the antigens on our own.

ST .HENRYS COLLEGE KITOVU

3. Melvin Calvin and his co-workers using a 'lollipop' experiment investigated the light-independent reaction. In this experiment single-celled algae are grown in the light in a thin-transparent 'lollipop'. Radioactive hydrogen-carbonate is injected into the 'lollipop'. This supplies radioactive carbon dioxide to the algae. At 5 seconds intervals, samples of photosynthesising algae are dropped into hot methanol to stop chemical reactions instantly.

The compounds in the algae are then separated out and those that are radioactive are identified. The 'lollipop' apparatus and a table summarising the results of the experiment are shown below.

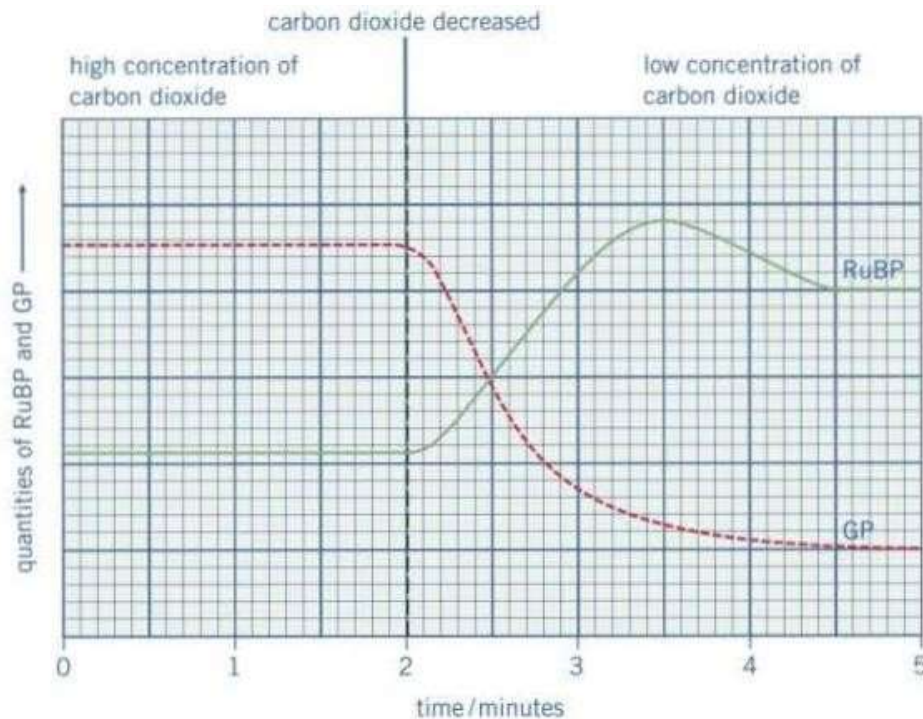


▲ Figure 7 The 'lollipop' apparatus used by Melvin Calvin

Time (seconds)	Substances found to be radioactive
0	carbon dioxide
5	glycerate-3-phosphate
10	glycerate-3-phosphate + triose phosphate
15	glycerate-3-phosphate + triose phosphate + glucose
20	glycerate-3-phosphate + triose phosphate + glucose + ribulose biphosphate

- Explain why the carbon dioxide supplied to the algae was radioactively labelled.
- Explain how the information in the table provides evidence that glycerate-3-phosphate is converted into triose phosphate.
- Suggest an explanation of how methanol might stop further chemical reactions taking place.
- Why was it necessary to conduct the 'lollipop' experiment in sufficient light conditions?

In a further experiment, samples of algae were collected at 1-minute intervals over a period of five minutes. The quantities of glycerate-3-phosphate (GP) and ribulose biphosphate (RuBP) were measured. At the beginning of the experiment, the concentration of carbon dioxide was reduced. The graph below shows the results of this experiment.

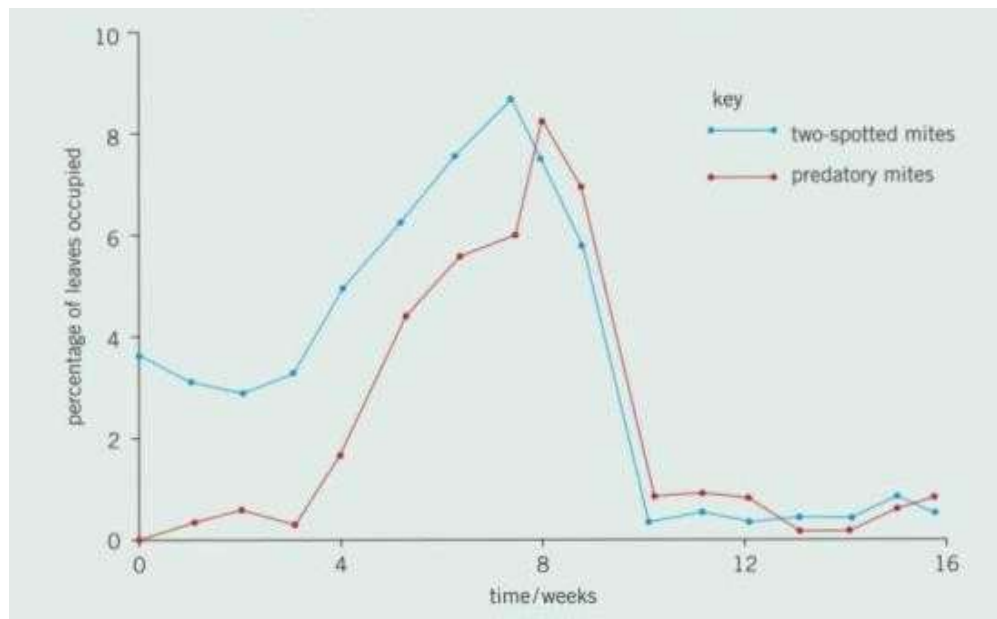


- (e) Describe the effects on the quantities of GP and RuBP on the decrease of carbon dioxide after two minutes.
- (f) Explain the changes to the levels of GP and RuBP.
- (g) Explain why the majority of plants are C₃ plants despite their disadvantage of photorespiration.

KAWEMPE MUSLIM SS

- 4(a) Insect pests of crop plants can be controlled by chemical pesticides or biological agents. What are the advantages and disadvantages of using biological agents?

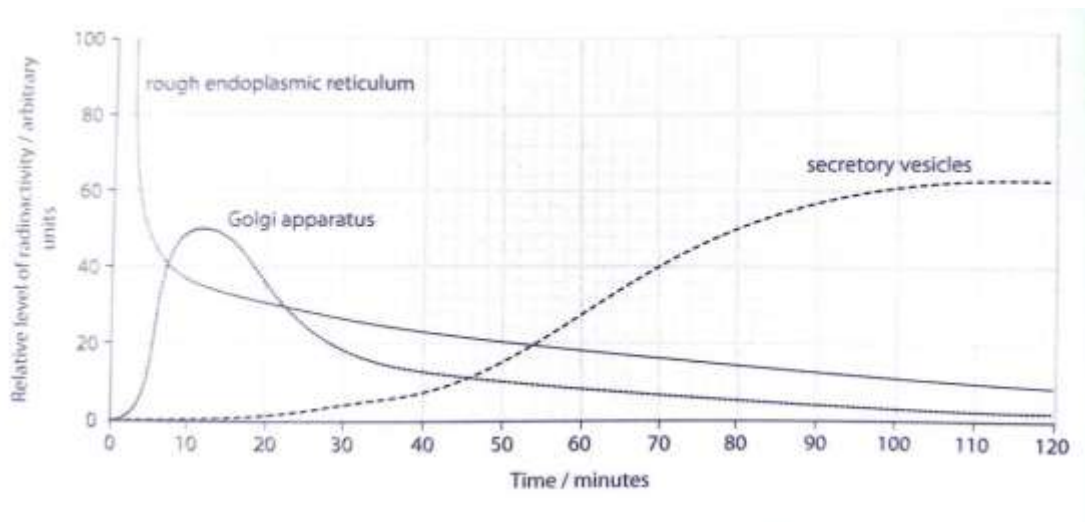
Two-spotted mites are pests of strawberry plants. Ecologists investigated the use of predatory mites to control two-spotted mites. They then recorded the percentage of strawberry leaves occupied by two-spotted mites and by predatory mites over a 16-week period. The results are summarised in the figure below.



- (b) Explain the relationship between the percentage of leaves occupied by predatory mites and two-spotted mites during the period of this investigation.
- (c) The ecologists concluded that in this investigation the control of by the two-spotted mites by biological agent was effective. Explain how the results support this conclusion.
- (d) Farmers who grow strawberry plants and read about this investigation might decide not to use these predatory mites. Suggest reasons for their decision.
- (e) The ecologists repeated the investigation but sprayed chemical pesticide on the strawberry plants after 10 weeks. After 16 weeks no predatory mites were found but the population of two-spotted mites had risen significantly. Give an explanation for the rise in the population of two-spotted mites.

MT ST MARY'S NAMAGUNGA

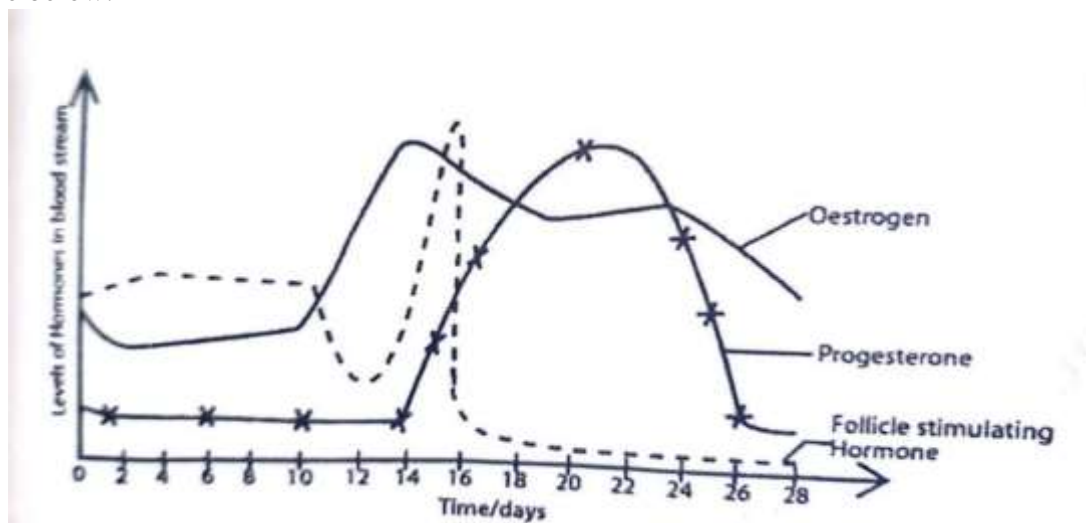
5. An investigation was carried out to track the movement of amino acids through different organelles in a cell. Pancreatic cells were provided with a small quantity of amino acids containing tritium atoms, ^3H , instead of normal hydrogen atoms. Tritium is radioactive, and molecules containing it can be detected. They are said to be tritium 'labelled'. After a short-time the pancreatic cells were provided with a large quantity of unlabelled amino acids. Samples of cells were extracted at particular times, and the levels of radioactivity in the rough endoplasmic reticulum, Golgi apparatus and secretory vesicles were determined. The results are summarised in the figure below.



- (a) Explain the pattern shown by these results.
- (b) Explain why the pancreatic cells were chosen for this experiment.
- (c) With evidence from the figure above state the sequence in which labelled amino acids moved through the three organelles.
- (d) Insulin does not enter liver cells but brings about its effects with a receptor on the liver cell surface.
 - (i) Explain why insulin molecules are not able to enter liver cells.
 - (ii) What kind of molecules in a cell membrane that could act as a receptor for insulin?
 - (iii) Explain how the binding of insulin on the surface membrane of liver cells causes a decrease in blood glucose concentration.

NAMILYANGO COLLEGE

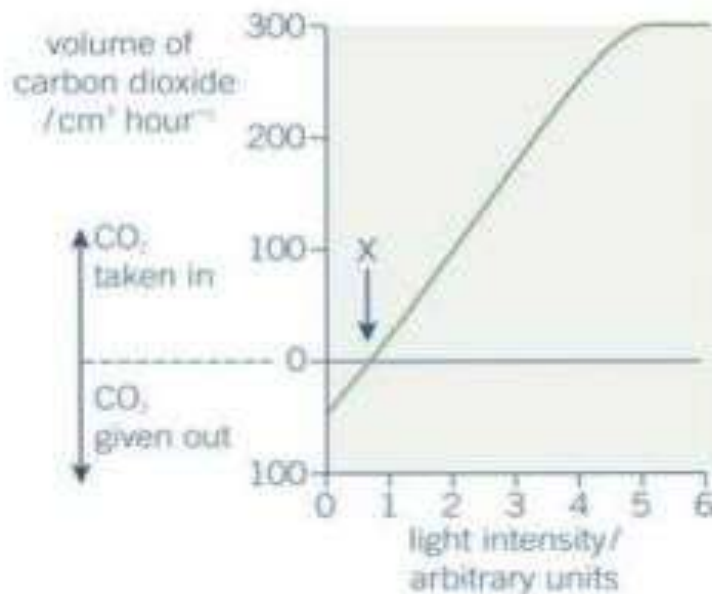
6. A study was conducted on the hormonal changes in the menstrual cycle a fertile female of a reproductive age. Periodical changes in the level of the gonadotrophic hormone, follicle stimulating hormone and two other steroid hormones, oestrogen and progesterone were studied over 28 days of the menstrual cycle. The hormonal changes are shown in the figure below.



- (a) Compare the variation in the levels of oestrogen and progesterone.
- (b) Explain the
 - (i) relationship between follicle stimulating hormone and oestrogen in the 28 days of the menstrual cycle.
 - (ii) variations in the level of progesterone throughout the cycle.
- (c) (i) Predict the changes in the levels of the three hormones if fertilisation occurs on the 17th day of the cycle.
- (ii) Suggest reasons for your answer in (c)(i) above.
- (d) Explain the significance of the three types of hormones in fertility drugs.

NABISUNSA GIRLS

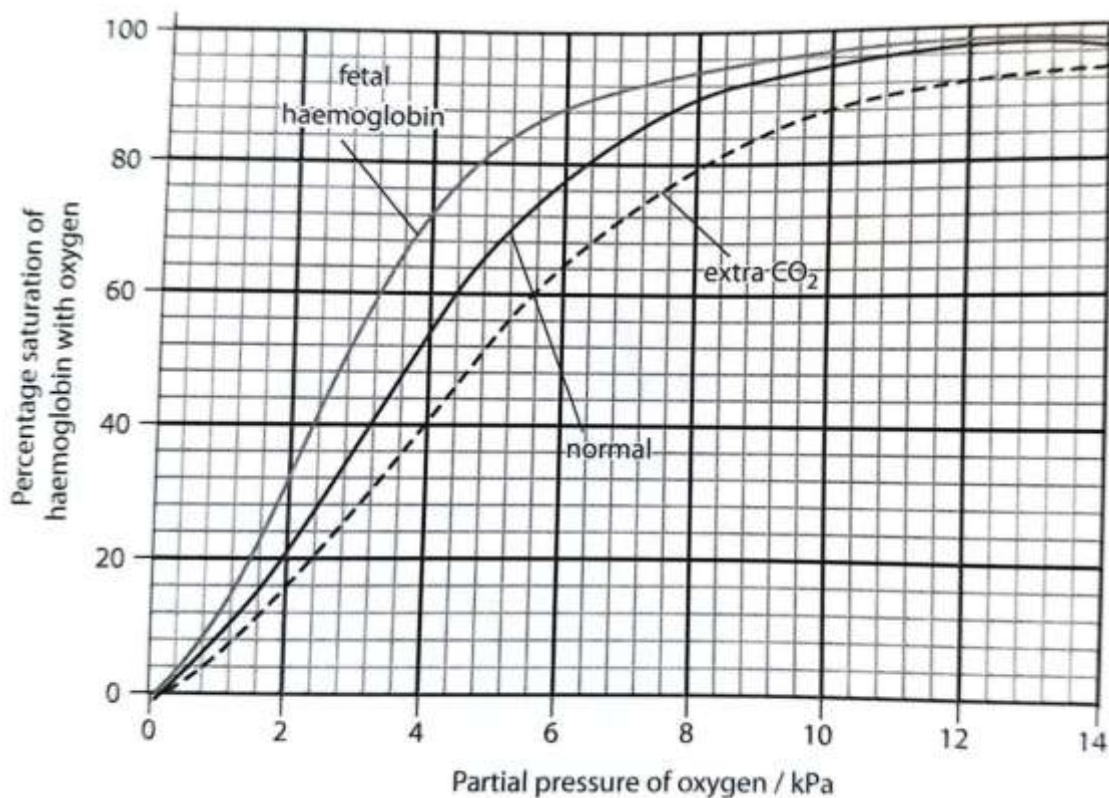
7. The figure below shows the volume of carbon dioxide produced by a sample of tomato plants at different light intensities.



- (a) Explain the effect of light intensity on carbon dioxide exchange in the tomato plants.
- (b) Explain why at point X neither carbon dioxide is not taken in nor given out.
- (c) Some herbicides cause the stomata of plants to close. Explain how these herbicides might lead to the death of plants.
- (d) Explain the advantage to a plant being able to control the opening and closing of the stomata.
- (e) Water flow over the fish gills is one-way whereas the flow of air in and out of the mammalian lungs is two-way. Explain why the one-way flow of a fish is advantageous over the two-way flow in the mammalian lungs.
- (f) Outline the physiological effects in the body of breathing in excess
 - (i) carbon dioxide
 - (ii) oxygen.

UBUNTU HILL SCHOOL

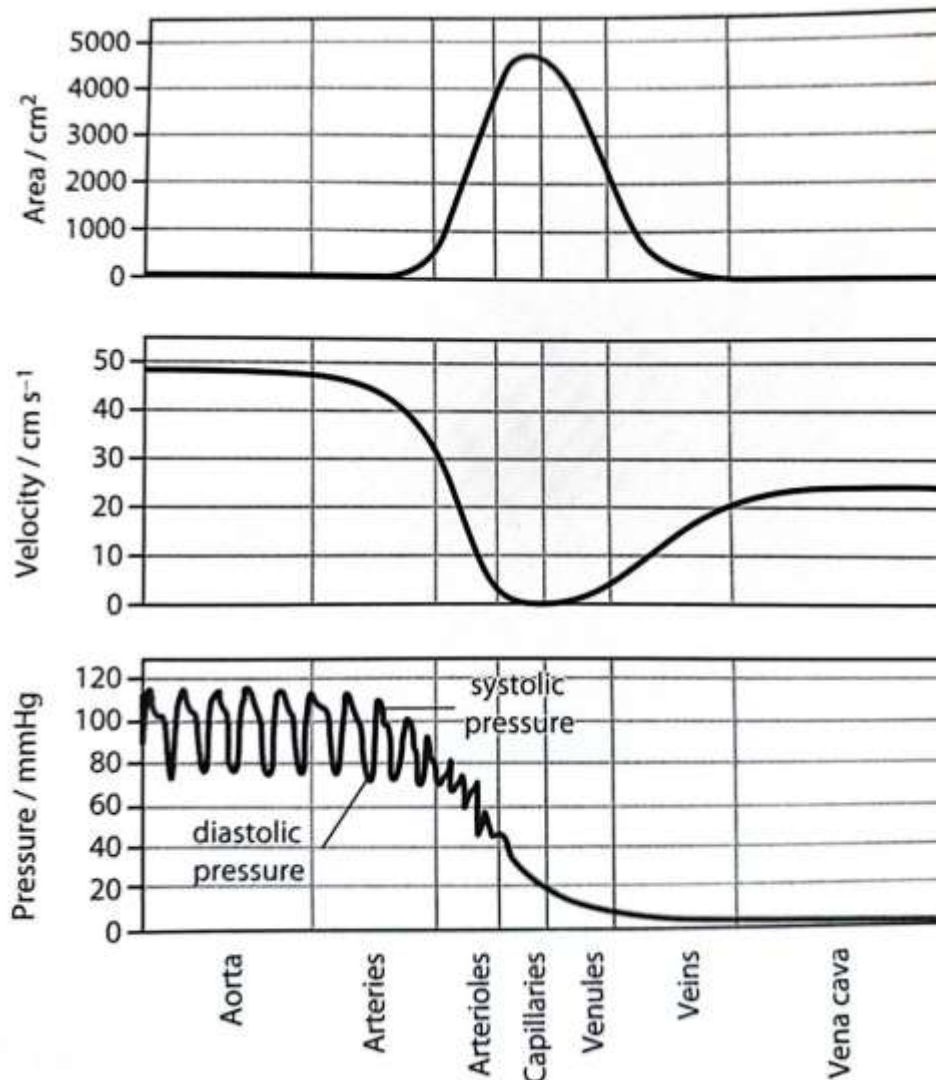
8. The figure below shows the oxygen dissociation curves of human haemoglobin in the presence of a range of concentrations of carbon dioxide.



- (a) Explain how the structure of the haemoglobin molecule generates an oxygen dissociation curve that is sigmoid.
- (b)
 - (i) The partial pressure of oxygen in the alveoli 12 kPa. Use the graph to determine the percentage saturation of normal haemoglobin in the alveoli.
 - (ii) 1 g of fully saturated haemoglobin carries 1.3cm³ of oxygen. Calculate the volume of oxygen bound to 1 g of haemoglobin at a partial pressure of 12 kPa.
 - (iii) Use the graph to determine the volume of oxygen released to rapidly respiring cells.
- (c) Why is it an advantage to the body for the dissociation curve to take the orientation shown on the graph at a high carbon dioxide concentration?
- (d) Explain why the foetal oxygen dissociation curve is different to that of the normal adult haemoglobin.
- (e) Explain how the of red blood cells maximises the transport of oxygen to tissues.

GOMBE SS

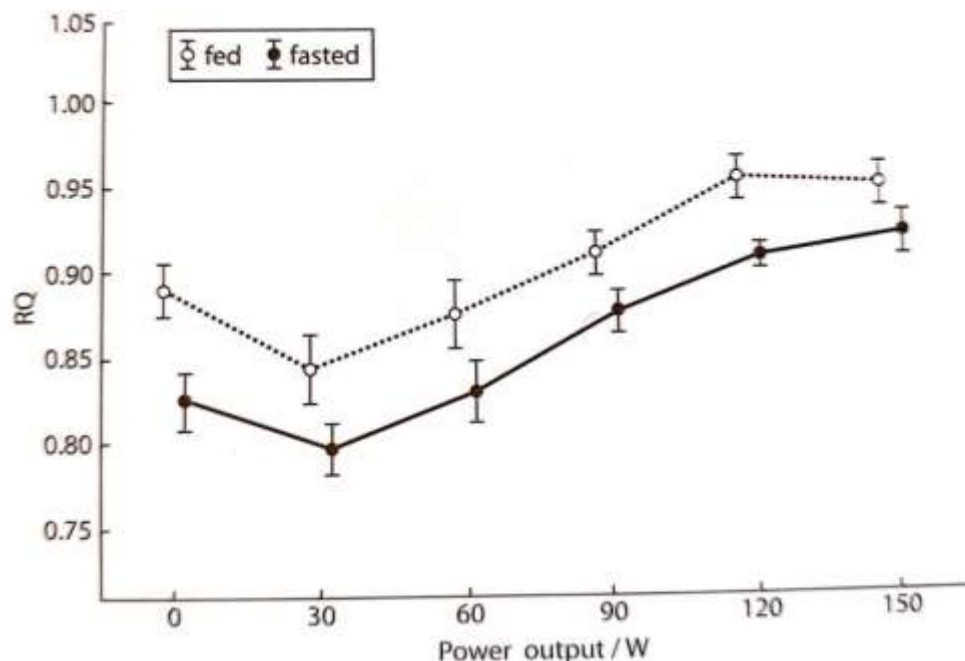
9. The figures below show how blood pressure, cross-sectional area and blood velocity change in different blood vessels.



- (a)
 - (i) Explain how the blood pressures change as blood moves from the aorta to the vena cava.
 - (ii) Explain how the velocity changes as blood flows from the aorta to the vena cava.
- (b) When an animal is wounded, its overall blood pressure rises, but the area in the vicinity of the wound swells as a result of local vasodilation. Suggest what the advantage of these changes might be.
- (c) Describe the role of the nervous and hormonal systems in the control of the heart rate.
- (d) Outline the adjustments that occur to the heart rate and circulatory system just before, during and after a vigorous exercise.

GAYAZA HIGH SCHOOL

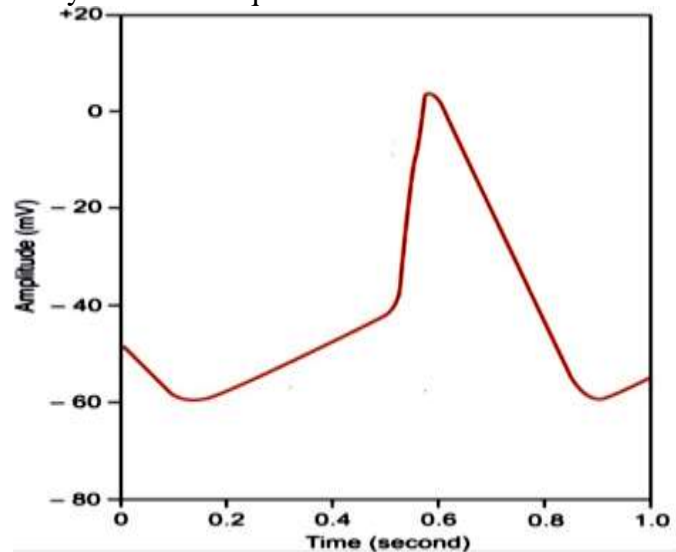
- 10 An investigation was carried out into the effect of fasting on the RQ of two students. One of the students was given no food (fasting) for 12 hours while the other ate a normal balanced diet. The students were then made to exercise at increasing intensities in rooms set at the same temperature and humidity. The volumes of oxygen used in their bodies and carbon dioxide produced were measured and the RQ calculated for the different exercise intensities. Intensity was measured as power output. The results are shown in the figure below.



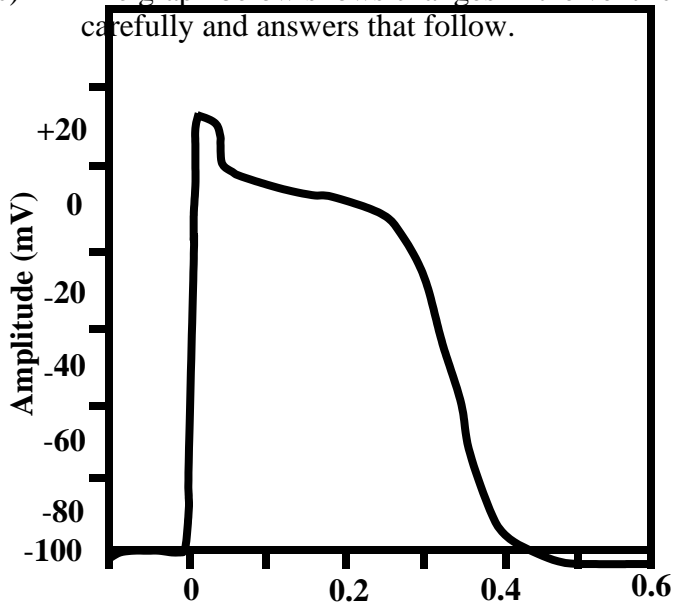
- (a)
 - (i) The temperature and humidity of the room were kept the same. Suggest two factors that would need to be controlled.
 - (ii) Compare the effects of increasing exercise intensity on RQ of the two students.
 - (iii) Explain the results obtained in the figure above.
- (b) Migratory birds like geese have a much higher ratio of saturated fatty acid than non-migratory birds such as ostriches. Explain the reasons for this difference.
- (c) Most hibernating animals have an RQ between 0.8 to 0.9. Give an explanation for this observation.
- (d)
 - (i) Describe the process of ATP synthesis in the mitochondrion.
 - (ii) Outline the ways in which ATP is used by the cells.
- (e) Explain why the majority of plants cannot survive in flooded soils but rice can.

ST MARY'S COLLEGE KISUBI

- 11(a) The figure below shows the variation of the amplitude (potential) of the SAN of human cardiac muscle (pacemaker) with time. The resting potential of the SAN is -55 mV. Study the graph carefully and answer questions that follow.



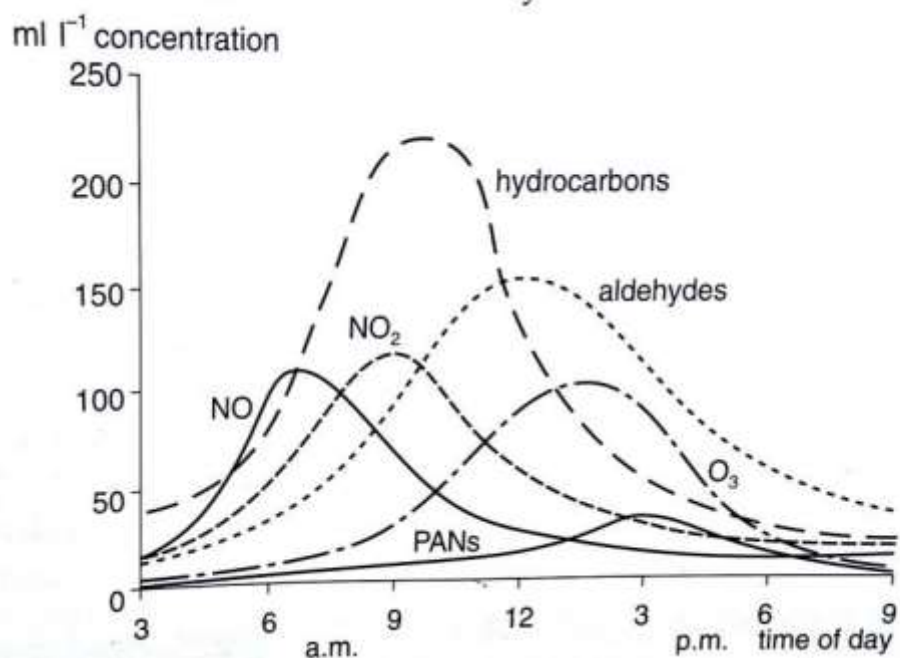
- (i) Describe the changes in the potential/amplitude of the SAN with time.
(ii) Account for the above changes in the figure above.
- (b) (i) Explain the effects of the different innervations to the SAN.
(ii) Explain the functions of the conducting systems of the heart.
- (c) The graph below shows changes in the ventricular action potential. Study the graph carefully and answers that follow.



- (i) From the graph above describe changes in the ventricular action potential.
(ii) Explain the changes in the ventricular action potential.
(iii) Account for the significance of the changes represented above.

SEETA HIGH SCHOOL

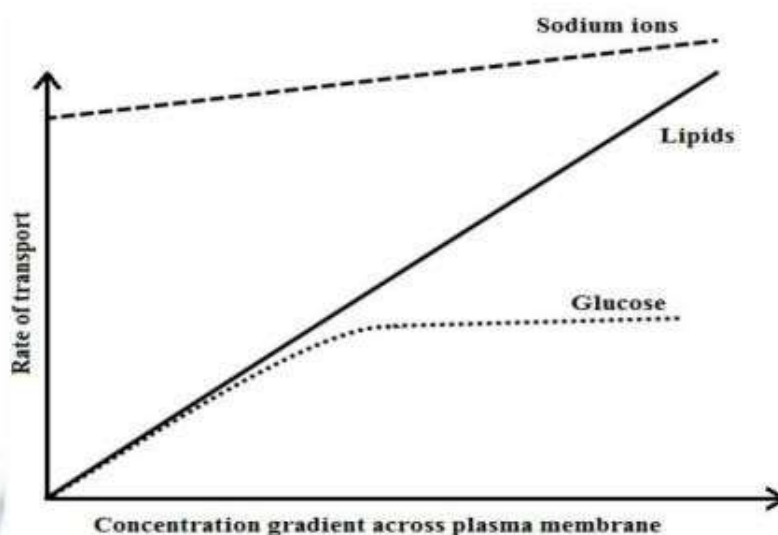
- 12(a) The graph below shows the composition of the photochemical smog on a sunny day in Kampala city. Study it carefully and answer questions that follow.



- Explain why the concentrations of NO, NO₂ and Hydrocarbons increase in the morning.
- Suggest an explanation for the timing of the peak concentrations of NO and NO₂.
- Explain how hydro-carbons accelerate the formation of Ozone hole.
- Explain the increase in the concentration of PANs (peroxyacetyl nitrate) in the mid-morning.
- Why might cyclists advised not to leave work early in order to avoid rush-hour traffic.
- Explain why the peak of the Hydrocarbons is higher than any other pollutant.

TRINITY COLLEGE NABBINGO

- 13, The graph below shows the rates of transporting sodium ions, lipids and glucose across the membrane of living cells.

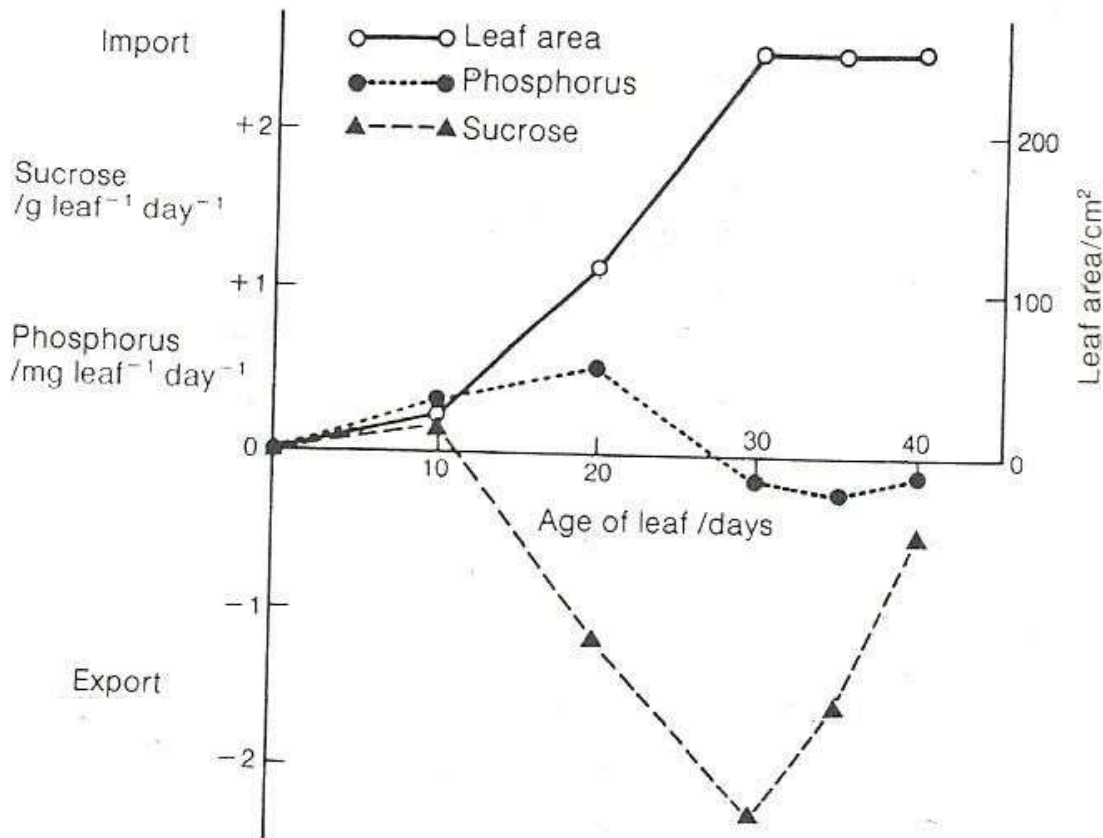


- (a) Describe the rate of transport of each substance across the plasma membrane.
- (b) Account for the observed trends in the transport of sodium ions and glucose.
- (c) Compare the rate of lipid and glucose transport.
- (d)
 - (i) Explain how the mechanisms of transportation of substances in (b) above are beneficial and disadvantageous to cells.
 - (ii) Outline the adaptations cell membranes for the mechanisms of transport explained in (d) (i) above.

UGANDA MATYRS SS NAMUGONGO

- 14 Figure 1 below shows the growth of a single plant leaf with its **import** (+) and **export** (-) of sucrose and phosphorus during a period of 40 days. Study the figure and answer the questions that follow.

Figure 1



- (a) From figure 1 above, explain the relationship between:
- Leaf area and movement of sucrose.
 - Age of leaf and movement of phosphorus.
- (b) Describe how the following are imported and exported through the leaf:
- Sucrose.
 - Phosphorus.

Figure 2 shows how external factors affect stomatal opening in various plants. Study the figure and answer the questions that follow.

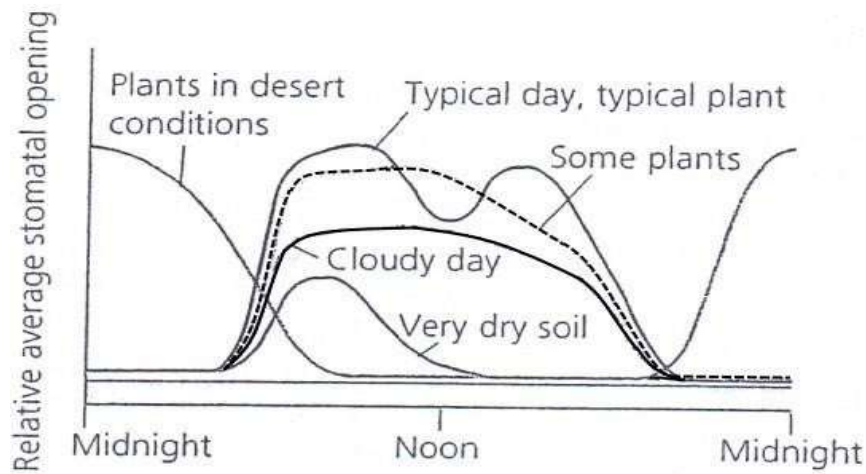


Fig. 2

- (c) Compared with a typical plant on a typical day, describe the effect of the following conditions on stomatal movement:
- Very dry soil.
 - Cloudy day.
- (d) Considering the plants in desert conditions:
- What are the **advantages** and **disadvantages** of the observed stomatal movement?
 - Explain how structural features are indicative of their habitat.

KINGS COLLEGE BUDO

- 15
- Outline the features which are unique to the skeletal muscle.
 - How is the structure of myosin filament suited to its role in the muscle contraction?
 - Describe the events which lead to the shortening of the skeletal muscle.
 - Explain why rigor mortis occurs after death.

ST JULIAN SCHOOLS

- 16
- Explain why nitrogenous waste do not normally occur in plants.
 - How does the human body deal with excess amino acids.
 - In the mammalian kidneys the relative length of the loops of Henle shows considerable variation from one species to another. Suggest with reasons type of habitats in which you expect to find species with extremely long and short loops of Henle.

- (d) Nitrogenous waste in animals may occur as ammonia, urea or uric acid. The table below shows the percentage of these three compounds in the urine of four different animals.

	Ammonia	Urea	Uric acid
Fresh water fish	56	6	0
Sea water fish	7	81	0
Lizard	0	0	91
Bird	3	4	72

- (i) Explain the difference in the main excretory compound in fresh and sea water fish.
- (ii) Both the lizards and birds are terrestrial and egg-laying. How do these characteristics relate to the nature of their main excretory products?

IGANGA SS

- 17 (a) Explain why it is important to study food webs rather than food chains in an ecosystem.
- (b) Consider the trophic levels of a pyramid of numbers and illustrate how energy is lost in passing through the levels.
- (c) Describe the ways in which nitrogen is incorporated into a food chain.

KAKUNGULU MEMORIAL SCHOOL