Association of Biology Educators (ABE)

2023 'A' LEVEL NATIONAL SEMINAR-SERIE No: 6 HELD AT NGORA HIGH SCHOOL, NGORA (U) ON THE SATURDAY 30TH SEPTEMBER, 2023

This write up is a university link, and has been epically designed as part of ABE National seminar series of the 2023. The Association of Biology Educators (ABE) team has curated sample questions to ease your revision, using expert guidance. i) Senior 5 and 6 topics (according to NCDC syllabus); ii) Plant and Animal biology; iii) 4 themes, i.e., Cell Biology topics, Ecology, Maintenance of life topics & Continuity of life topics.

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FOREWORD

This write-up is a ***university link***. The Association of Biology Educators (ABE) team has curated sample questions to ease your revision, using expert guidance.

A-level Biology Revision Tips

- First, set your Biology goal. What final grade do you aim to score in Biology? Do you know the individual paper scores needed to clinch **A, B, C, D, E, O** *or* **F**?
- Next, create a revision timetable. Revise Biology **daily**, during hours when your brain is fresh.
- Manage your time effectively - Adhere to your Biology reading time table, no matter what!
- Balance your revision as per **3 simple** guidelines:
  i) Senior 5 and 6 topics (according to NCDC syllabus);
  ii) Plant and Animal biology;
  iii) 4 themes, i.e., Cell Biology topics, Ecology, Maintenance of life topics & Continuity of life topics.
- Outside the exam season, actively participate in as many discussions as possible with classmates.
- During revision, practice drawing using well-sharpened pencil as though you are in the exam.

How to use this write-up

You can read this work from cover to cover, or you can dip in and out of the different topics as needed.

As a student, first read your notes to understand the key concepts. Once you have understood the basics in a given topic, start answering questions. In this work, questions are arranged in a sequence following the Uganda Biology syllabus. Therefore, you can quickly locate the topics where you need to focus your revision.

Note that whereas this work covers all the key concepts and principles, it does not exhaust all the possible questions in each topic. Accordingly, use it alongside your notes, textbooks and any other materials recommended by your teachers.

I hope that you find this work helpful. Good luck with your exams!

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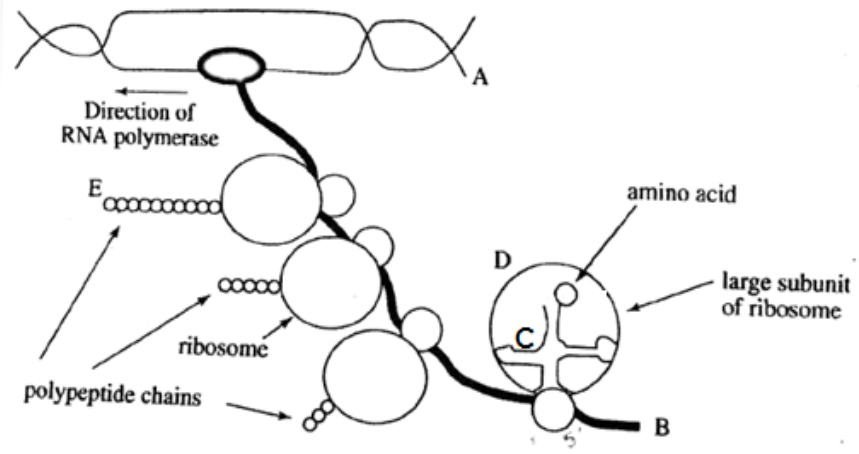
THEME 1: CELL BIOLOGY

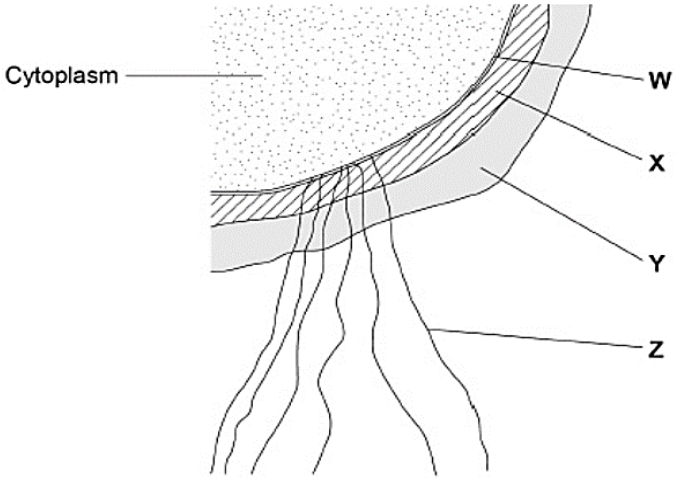
1.1 CELL STRUCTURE AND FUNCTION

1.1.1 The figure below represents simultaneous transcription and translation in E. coli. The arrow gives the direction of the RNA polymerase. Answer the following questions about the structures represented in the drawing.



(a) To which direction does RNA polymerase move?
(b) Identify structures A, B, and C.
(c) Describe how D is formed?
(d) Compare molecules B and C.
(e) Of what significance is it for man ribosomes being attached to molecule B?

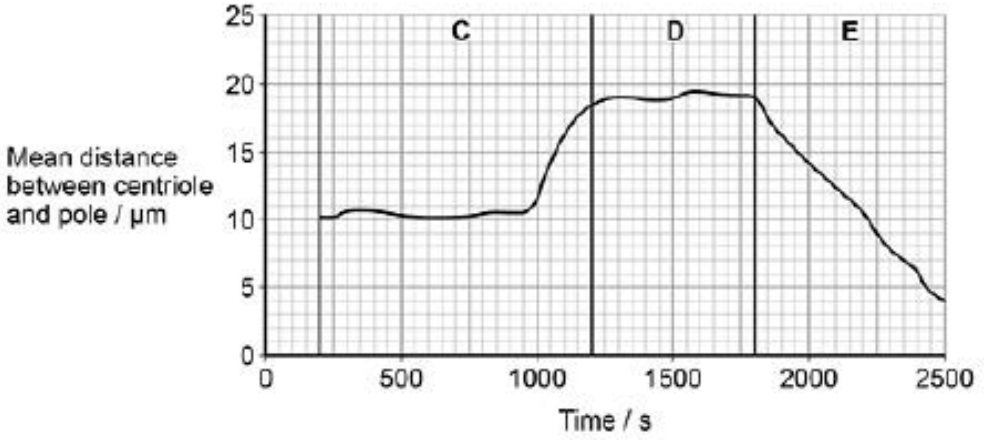
1.1.2 The diagram shows part of a prokaryotic cell.



(a) Name structures labeled W to Z in the diagram and state their roles.
(b) Name the main biological molecule in W and X.
(c) Compare the structure of the above cell and that of an eukaryotic cell.
(d) Describe the process by which the above cell divides.

1.2 CELL DIVISION

1.2.1 (a) The figure below shows the mean distance between centromeres and the poles (ends) of the spindle during mitosis.



(i) Calculate the rate of movement of the centromeres during phase **E**.
Give your answer in µm minute–1
(ii) Name the three phases of mitosis shown by **C**, **D** and **E** on the figure above.
(iii) Describe the role of the spindle fibres and the behaviour of the chromosomes during each of these phases.
(b) Scientific investigation on the cell cycle in heart cells taken from mice 6 days before their birth and then at 4, 14 and 21 days after their birth. Their results are shown in the table below. Age 0 days = day of birth.

Age / days	Percentage of heart cells undergoing mitosis	Percentage of heart cells undergoing DNA replication
−6	13.9	8.5
4	8.5	2.6
14	1.6	0.2
21	0.6	0.0

Describe and explain the data in the table above.

1.3 CHEMICALS OF LIFE

1.3.1 (a) Distinguish between the following compounds

(i) Amylose and Amylopectin (05 Marks)

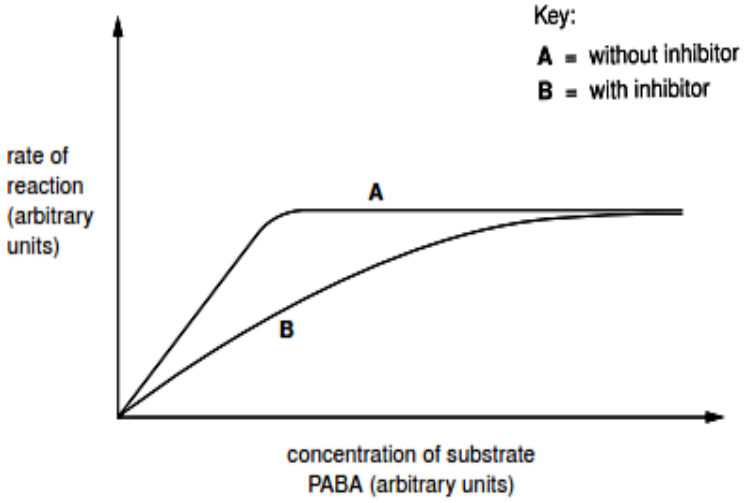
(ii) Starch and glycogen (04 marks)

(b) What functions do carbohydrates serve in mammalian bodies? (11 Marks).

1.3.2 The figure shows the effect of increasing the concentration of the substrate (PABA) on the rate of reaction.

Curve A shows the rate of reaction without the presence of the competitive inhibitor sulfonamide.

Curve B shows the rate of reaction in the presence of the competitive inhibitor sulfonamide



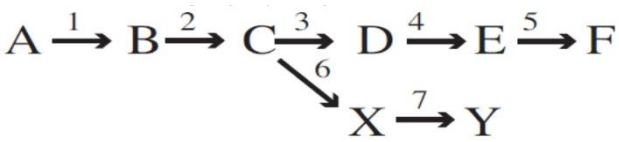
(a) Explain the effect of increasing the concentration of substrate on the rate of reaction;

(i) Without inhibitor

(ii) With inhibitor.

(b) Antibiotic resistance in bacteria is becoming an increasing problem. Describe how a sulfonamide-resistant population of bacteria could develop.

1.3.3 (a) Consider the following enzyme pathway.



Explain what would happen;

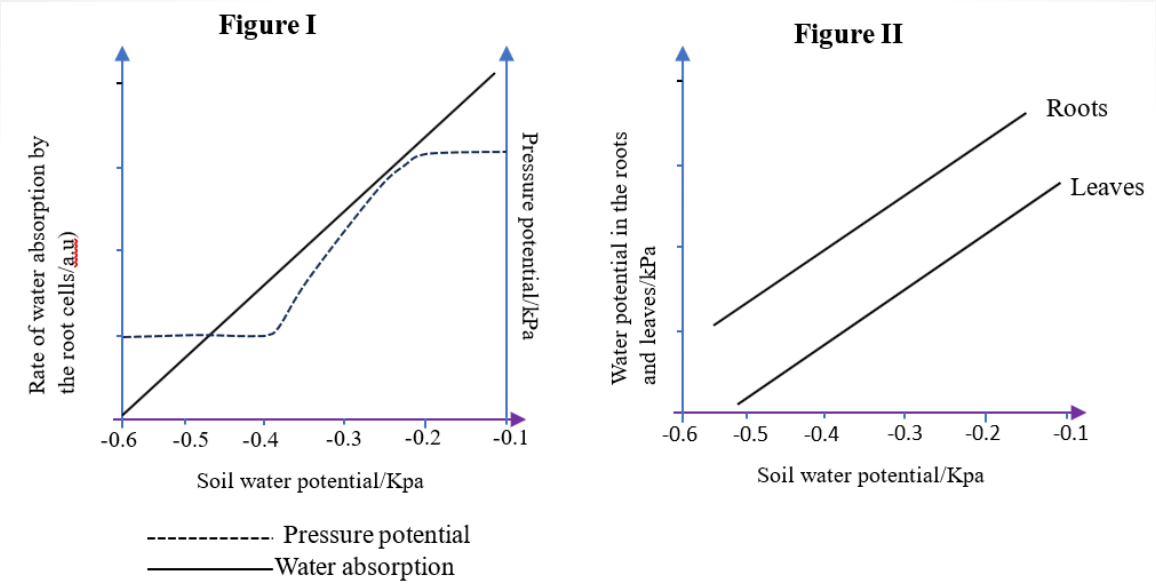
(i) To the activity of enzymes 4 and 5 when substance F accumulates.

(ii) When substance C decreases.

(b) How does the spatial arrangement of enzyme proteins in membranes help regulate enzyme activity?

1.4 CELL PHYSIOLOGY

1.4.1 Figure I shows an experiment carried out to find out the effect of water potential on water absorption by the roots. The plant was first put in water with high solute concentration until the root hair cells got fully plasmolysed. The plant was then transferred to dilute water. The rate of water absorption and pressure potential of the root hair cells were measured. Figure II shows the changes in the water potential of the leaves and the roots.



(a) From figure I

(i) Compare water potential and pressure potential with changes in the soil water potential.

(ii) Explain the variations in the pressure potential of the roots with changes in the soil water potential.

(iii) Predict and explain the effect of soil water potential on the productivity of the plant.

(b) From figure II

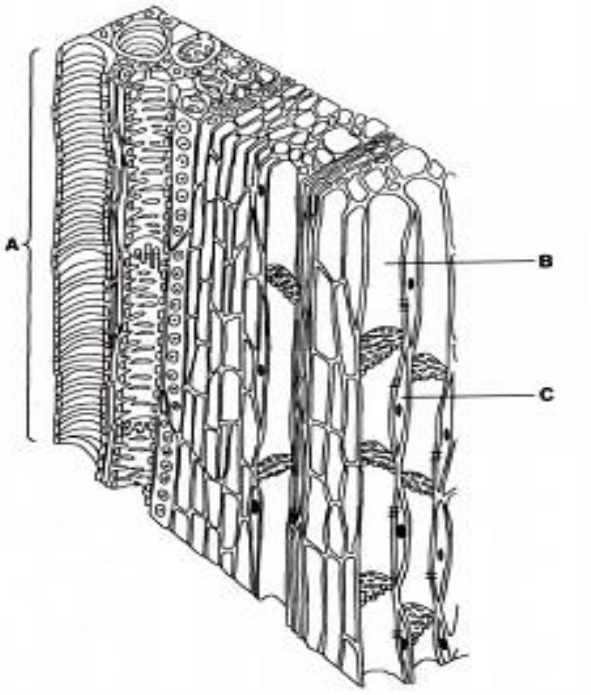
(i) Explain the effect of soil water potential on the water potential of the roots.

(ii) Describe the significance of the observed difference in the water potential of the leaves and roots during water movement in the plant.

(c) How do changes in the water potential of the guard cells affect the rate of transpiration?

1.5 HISTOLOGY

1.5.1 The figure below is a three dimensional diagram of part of a plant stem.



(a) Identify structure labelled A and B state the function it performs in the stem.

(ii) How is structure A adapted to fulfill its function?

(b) (i) Structures B and C function together. Identify them and state their role in the stem.

(ii) How are parts B and C able to perform their function?

THEME 2: ECOLOGY

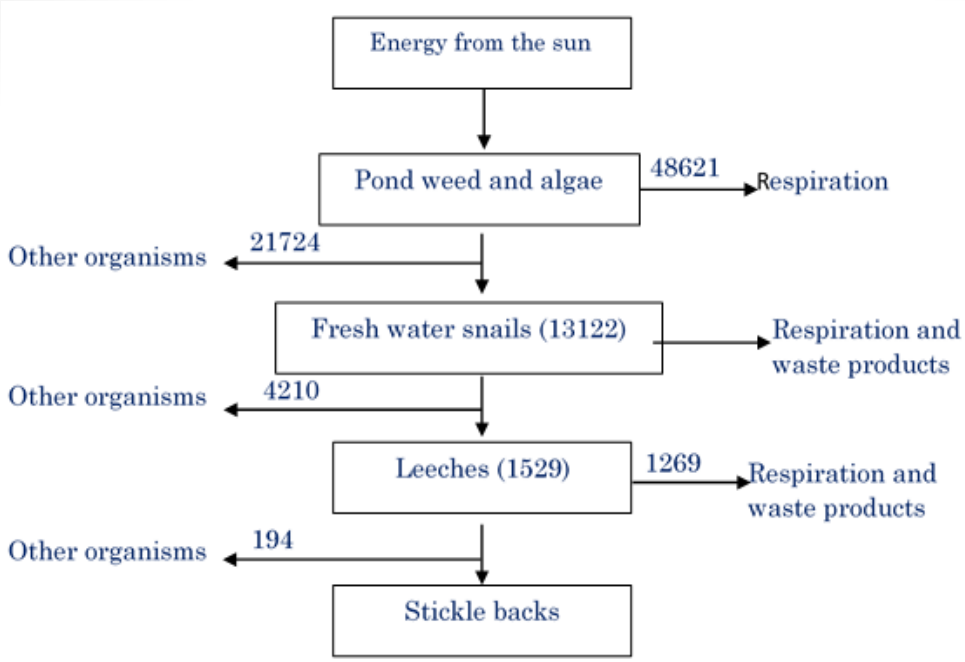
2.1 (a) (i) What structural and physiological features distinguished fungi from bacteria?

(ii) Discuss the various Problems associated with the transition from an aquatic to a terrestrial environment.

(b) What are the different strategies employed by plants to survive on land?

2.2 (a) What is meant by gross primary productivity?

(b) The diagram below shows the energy flow in $KJm^{-2}year^{-1}$ through a fresh water ecosystem.

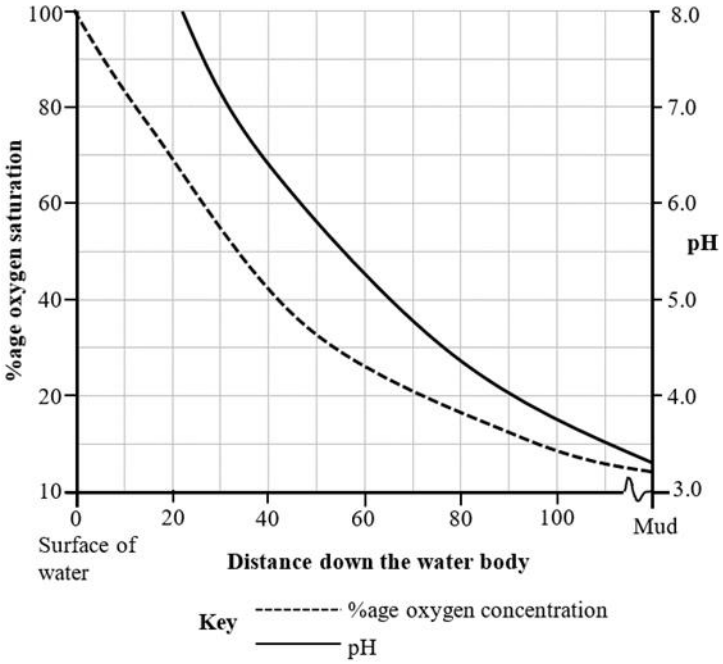


i) Calculate the gross primary productivity of the pond weed and algae.

ii) How much energy is lost in respiration and waste products by the fresh water snails?

c) Explain why carnivores would have a higher secondary productivity than herbivores.

2.3 In an ecological study of an aquatic habitat, a researcher carried out experiments on a small stagnant water body that had been left behind a swamp during a long drought. He observed a surface that contained some decomposing leaves and grass. After carrying out his experiments, the results on the saturation of oxygen and pH of water at the various depths of the water body were put in a table as shown below.



(a) From the graphs above, explain the relationship between the distance down the water body with %age oxygen concentration.

(b) Give an account of the effect of pH and oxygen concentration on aquatic organisms

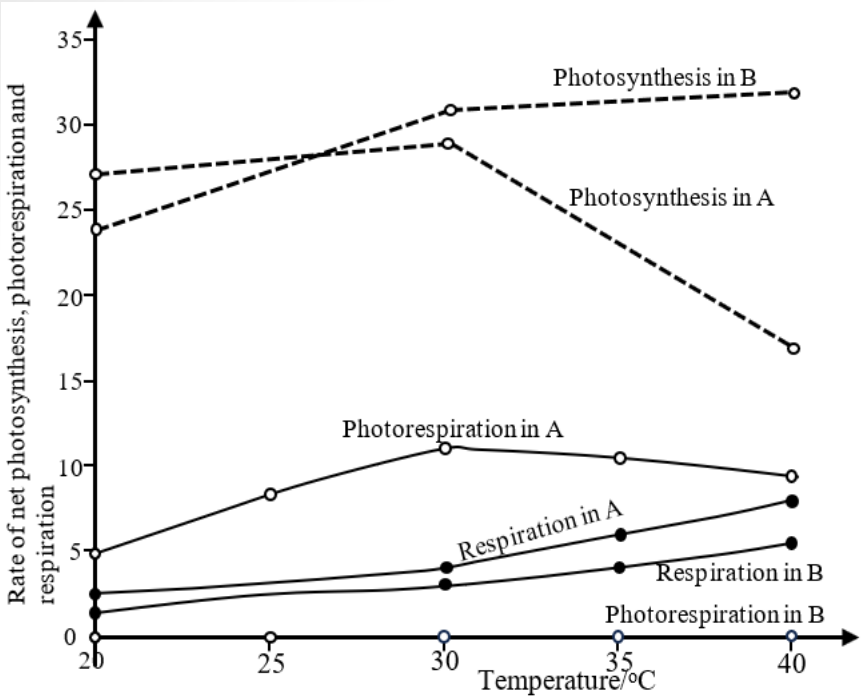
(c) How are air-breathing aquatic mammals adapted to the environment represented in the graph?

(d) Briefly describe the method used to find out the number of fish in a bond, assumptions, and precautions taken.

THEME 3: MAINTAINANCE OF LIFE

3.1 NUTRITION

3.1.1 Two plant **species A** and **B** were grown and placed under the same conditions. The graph below shows their rates **of net photosynthesis** (carbon dioxide uptake in the light), **respiration** (carbon dioxide released in the dark), and photorespiration at different temperatures measured in terms of carbon dioxide flux (mg of CO_2 exchanged per dm^3 of leaf surface per hour).



(a) Compare the;
(i) Net rate of photosynthesis,
(ii) Rate of photorespiration,
in the two plant species.
(b) Using the graph above:
(i) To what extent does the information illustrate the relative photosynthetic efficiencies of the two plant species **A** and **B**?
(ii) Identify the types of plant species **A** and **B** basing on their photosynthetic mechanisms.
(c) Describe the physiological and structural advantages of plant species **B** over **A.**
(d) Briefly explain the effects of photorespiration on the rate of photosynthesis in the plant species **A**.

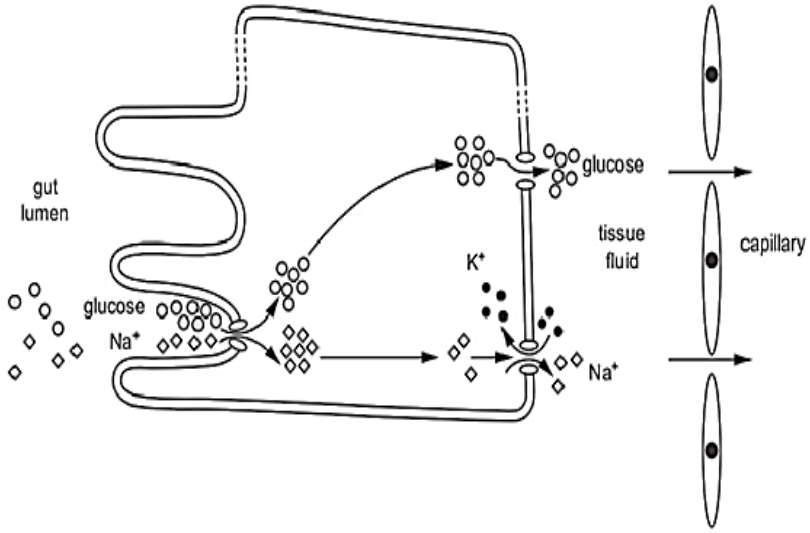
(e) Explain the following observations:

(i) Photosynthesis in $\mathbf{C_4}$ plants is not enhanced by higher atmospheric carbon dioxide concentrations compared to $\mathbf{C_3}$ plants.

(ii) Plants carry out respiration yet photosynthesis produces energy.

(iii) Measuring the volume of oxygen produced by the plant is not the best method for measuring the rate of photosynthesis.

3.1.2 One role of an intestinal epithelial cell is the absorption of glucose from the gut lumen into the circulatory system. This involves different membrane transport proteins. The events occurring in an epithelial cell during the absorption of glucose are summarized in the figure below.

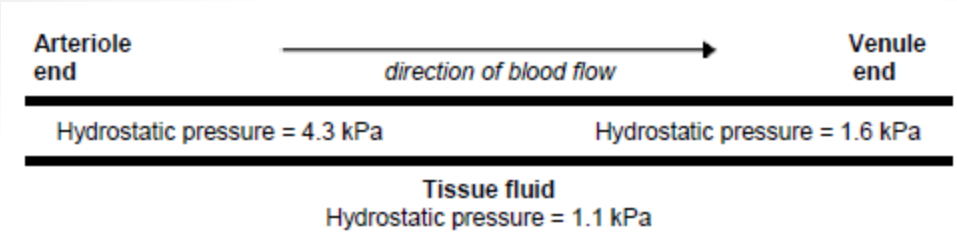


(a) (i) In reference to the figure above, describe the sequence of events involving glucose absorption.

(ii) Suggest why does glucose needs to be transported with sodium ions when it enters the cell through the cell membrane?
(b) How does the above form of transport regulate the osmotic balance inside the intestinal epithelial cell?
(c) Describe the changes that would occur in the epithelial cell membrane proteins when the water potential of blood rises above the norm.

3.2 TRANSPORT

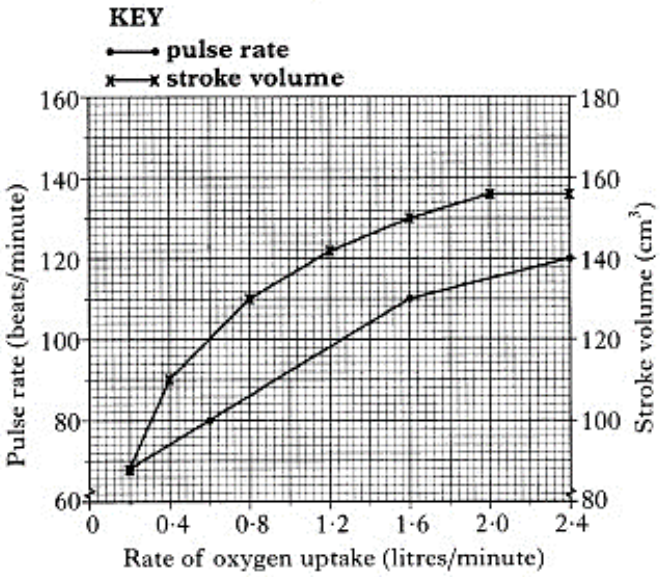
3.4.1 The figure below represents a capillary surrounded by tissue fluid. The values of the hydrostatic pressure are shown.



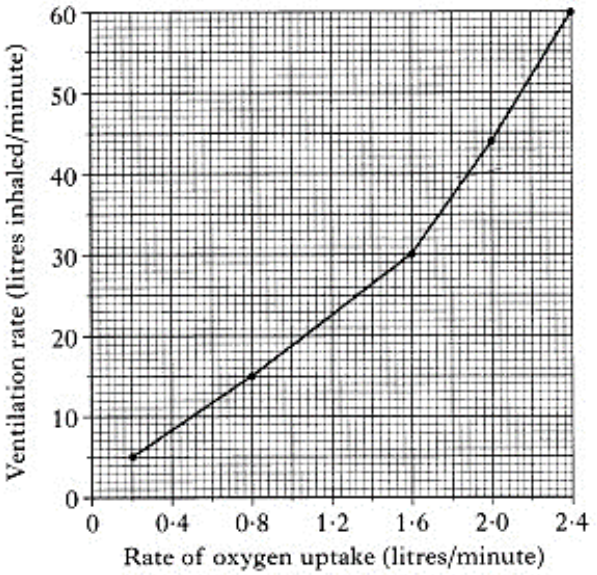
(a) Use the information in the figure above to explain how tissue fluid is formed.
(b) The hydrostatic pressure falls from the arteriole end of the capillary to the venule end of the capillary. Explain why.
(c) High blood pressure leads to an accumulation of tissue fluid. Explain how.
(d) The water potential of the blood plasma is more negative at the venule end of the capillary than at the arteriole end of the capillary. Explain why.

3.4.2 As the human body exercises, the pulse rate, stroke volume and ventilation rate change. The intensity of exercise is measured as rate of oxygen uptake.
Graph 1 gives information about the heart. It shows how pulse rate and stroke volume change with intensity of exercise in an individual. Stroke volume is the volume of blood pumped from the left ventricle of the heart in one beat.
Graph 2 gives information about the lungs. It shows how the ventilation rate changes with intensity of exercise in the same individual. Ventilation rate is the volume of air inhaled and exhaled in one minute.

Graph 1

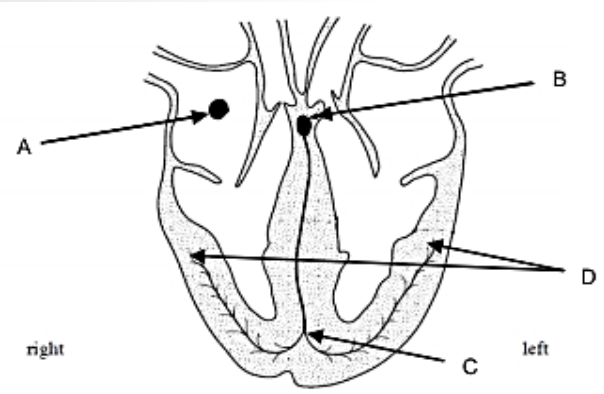


Graph 2



(a) With reference to **both graphs**
(i) Compare the pattern of changes in pulse rate and stroke volume as oxygen uptake increases.
(ii) Describe the observed changes in ventilation rate.
(b) From **both graphs**, explain the relationship between
(i) Stroke volume and exercise intensity.
(ii) Ventilation rate and exercise intensity.
(c) With reference to **Graph 1**, explain the physiological mechanisms that cause the changes in pulse rate and stroke volume during exercise.
(d) Suggest the potential risks and benefits of exercising at different levels of intensity.

3.4.3 Contraction of the heart is caused by a wave of excitation that passes from AA to D on the diagram below. The table shows the timing of a wave of excitation as it passes from A to D.



Sequence of transmission of wave of excitation	Time from start of wave of excitation (s)
Leaves A	0.000
Arrives at B	0.045
Leaves B	0.165
Arrives at C	0.205
Arrives at D	0.245

(a) Name parts labelled A to D.
(b) Describe and explain the effect of this wave of excitation on blood flow through the heart
(c) Explain the significance of the times shown in maintaining efficient blood flow.

3.3 DEFENCE AGAINST DISEASES

3.3.1 Figure I show the changes in the concentration of antibodies in the blood of an individual when injection A and injection B were given.
Figure II shows the effect of the entry of a pathogen on the body temperature.

Figure I

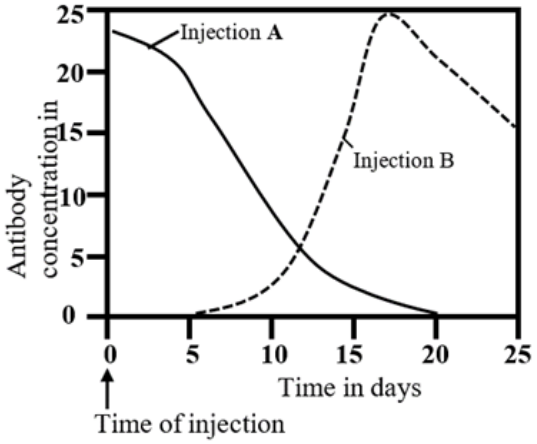
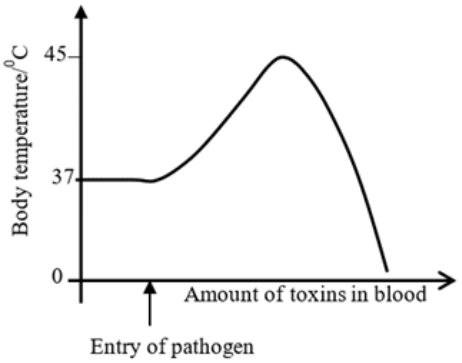


Figure II

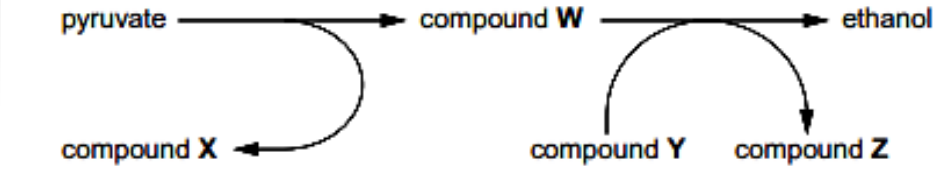


(a) Compare the antibody concentration when the two injections were used.
(i) Explain the differences in the antibody concentration when the two injections were applied.
(ii) Explain the effect of the application of injection B, on the concentration of antibodies in blood.
(iii) State the type of immunity acquired by the body for each type of injection given
(iv) State any four ways how antibodies work to defend the body
(b) (i) Describe the effect of entry of a pathogen on the body temperature.
(ii) Explain the changes in the body temperature caused by the entry of a pathogen.
(iii) How is important for the temperature of the body to increase in the presence of pathogens?
(iv) State any other five innate mechanisms used by the body to fight against disease-causing germs.

3.4 RESPIRATION

3.4.1 (a) Glycolysis is the initial stage of cellular respiration.
(i) State precisely where in the cell glycolysis occurs.
(ii) Outline the process of glycolysis.

(b) The fig. below outlines the process of anaerobic respiration in yeast.

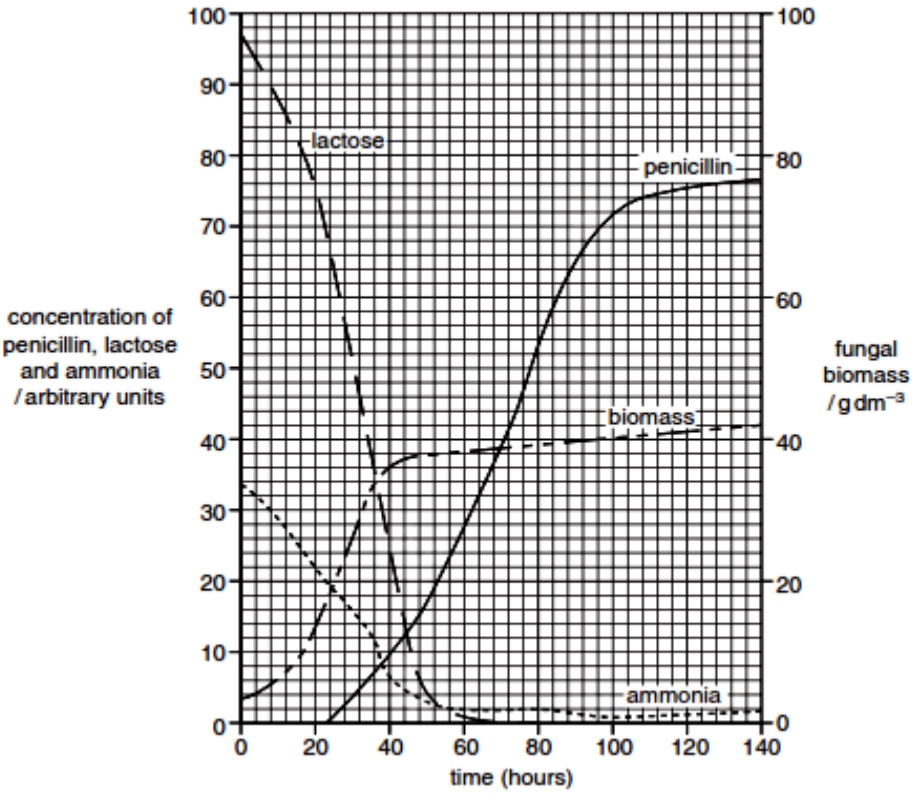


Identify the compounds W to Z.

3.4.2 (a) Explain how having a larger number of proton pores in the inner mitochondrial membrane would result in a person being less likely to gain weight.

(b) Outline the processes involved in the generation of ATP through chemiosmosis.

3.4.3 The antibiotic penicillin is produced by batch culture of the fungus *Penicillium chrysogenum*. The figure below shows the concentration of penicillin, lactose and ammonia as well as the fungal biomass over time when penicillin is being produced by batch culture.



(a) With reference to the graph, explain the relationship between the

(i) Concentration of lactose and penicillin.

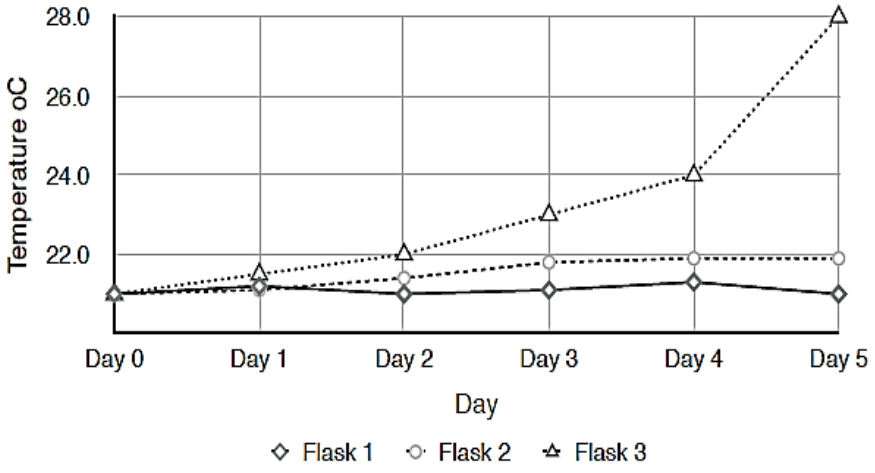
(ii) Concentration of ammonia and fungal biomass.

(b) Explain the factors that could affect the rate of production of penicillin by the fungus.

3.4.4 A student carried out an investigation into the decay of grass. He placed 200g of grass into each of three thermos flasks. All flasks had air holes in the lids. The thermos flasks are good insulators of heat.

- **Flask 1** grass + disinfectant
- **Flask 2** contained dry grass
- **Flask 3** contained wet grass.

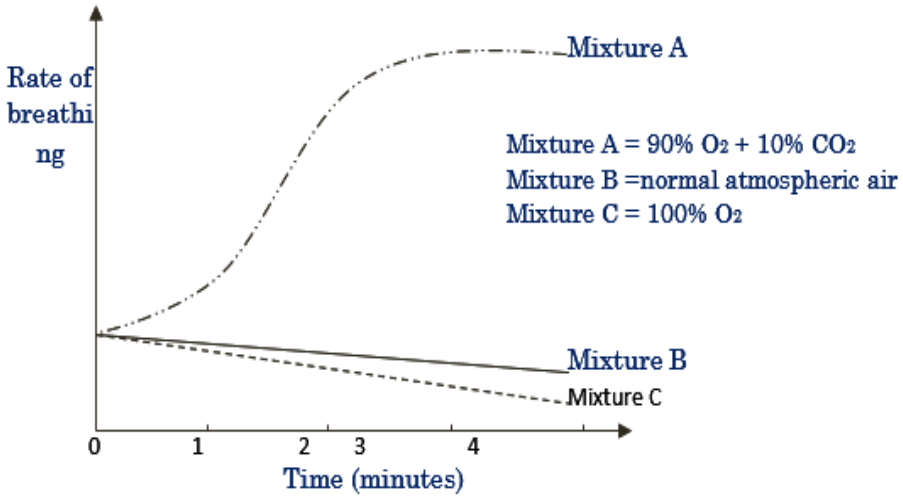
A temperature sensor was placed into each flask, and results from the investigation are shown in graph below.



(a) Compare the changes in the temperature between flask 2 and flask 3 the five days.
(b) Explain the changes in temperature for flask 3 from day 1 to day 5.
(c) The temperature for flask 1 changed very little. Suggest a suitable explanation why?

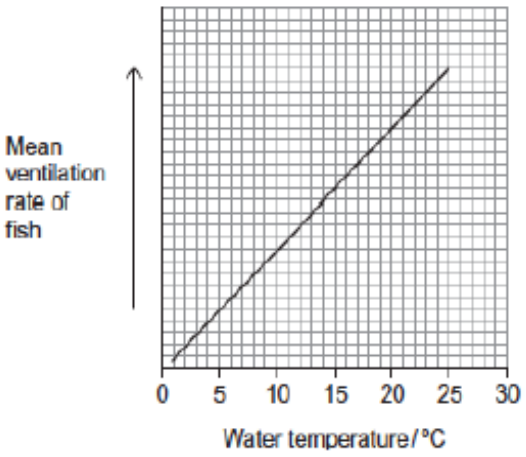
3.5 GASEOUS EXCHANGE

3.5.1 The figure below shows a graph of an adult human who was given various gaseous mixtures to breathe and the rate of breathing was measured.

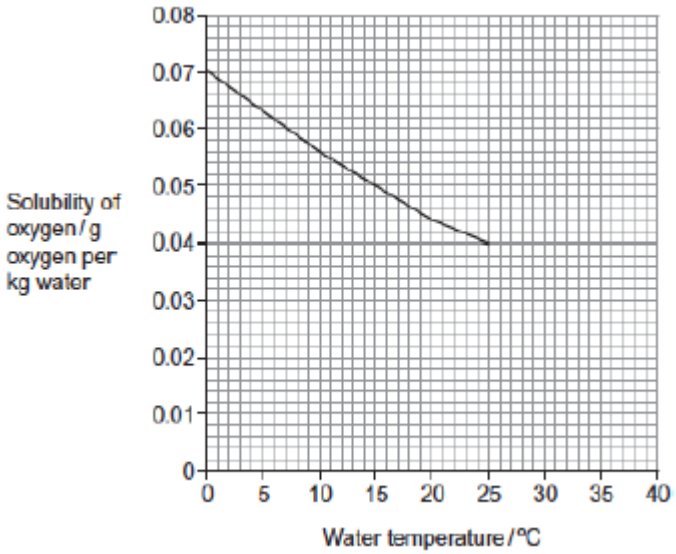


a) What is the effect of carbon dioxide concentration on the rate of breathing?
b) With reference to the graph, explain why mouth-to-mouth resuscitation is a better means of artificial respiration than pressing on the chest wall.
c) Explain the dangers of re-breathing expired air if it is first passed through soda lime.

3.5.2 A biologist investigated the effect of water temperature on the rate of ventilation of gills in a species of fish. She kept four fish in a thermostatically controlled aquarium and measured the mean ventilation rate by counting movements of their gill covers. Her results are shown in **Figure 1**.



In this investigation, the biologist also monitored the concentration of oxygen in the water in the aquarium. The concentration of oxygen in water changes with temperature of the water. **Figure 2** shows how it changes.



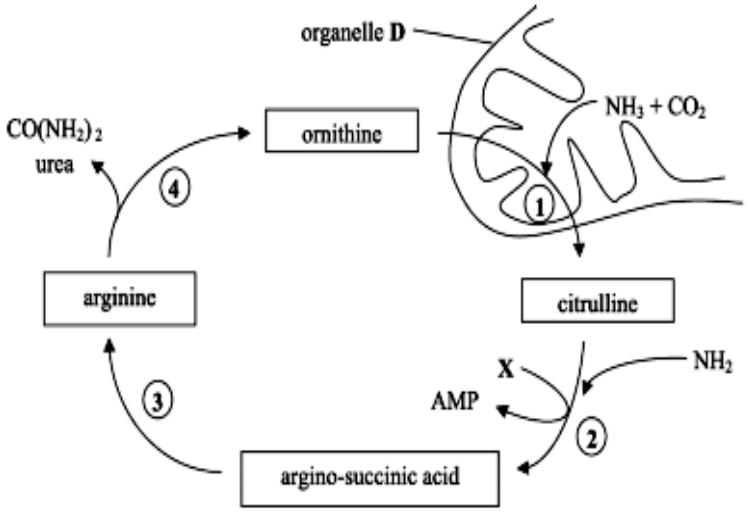
(a) Describe the relationship between temperature of the water, oxygen in water and rate of ventilation.
(b) Using figures 1 and 2, explain the advantage to the fish of the change in its rate of ventilation.
(c) Explain the advantage of counter current mechanism of ventilation in fish over the parallel mechanism.

3.6 HOMEOSTASIS

3.6.1 (a) Explain the role of the loop of Henle in the production of urine.

(b) Describe how the endocrine and nervous systems work together to increase water reabsorption from the collecting duct.

3.6.2 One of the main functions of the liver cells is the formation of urea by the ornithine cycle, an outline of which is shown in the figure below



a) Identify organelle D, where step 1 of the cycle takes place.

b) Explain how ornithine and citrulline move into and out of the organelle D respectively, during the cycle.

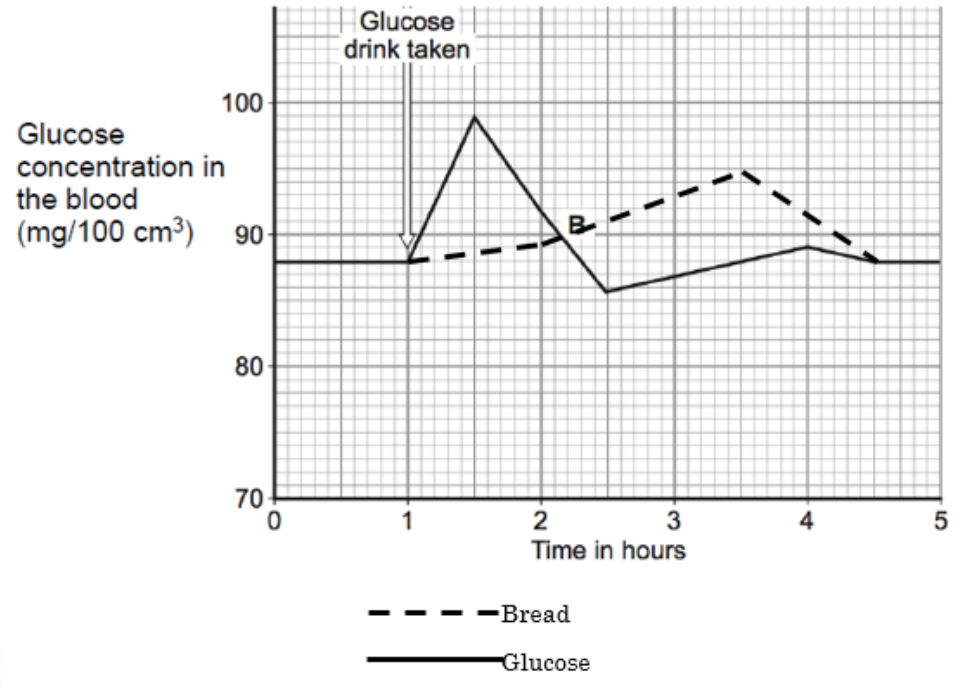
c) How has the ammonia that is used in step 1 been formed?

d) Identify the compound labelled X in the figure.

e) Describe how the mitochondrial membrane structure is related to the function of a mitochondrion.

3.6.3 The graph below shows the levels of blood glucose for a healthy person before and after taking a glucose drink.

In a similar experiment, the same person was given bread to eat instead of a sugar drink. Another graph was drawn to show changes in blood glucose when the bread was eaten compared to when the sugar drink was taken.



(a) Explain the changes in glucose concentration in blood over time period when glucose drink was taken.

(b) Explain the differences in blood glucose concentrations over time when the person ate bread.

(c) Explain the following.

(i) The skin becomes red when the body temperature rises.

(ii) A person begins to shiver immediately he leaves the sauna and jumps into a cold swimming pool.

(iii) Alcohol dilates blood vessels in the skins, thus dangerous to drink alcohol between going from sauna to swimming pool.

3.7 COORDINATION

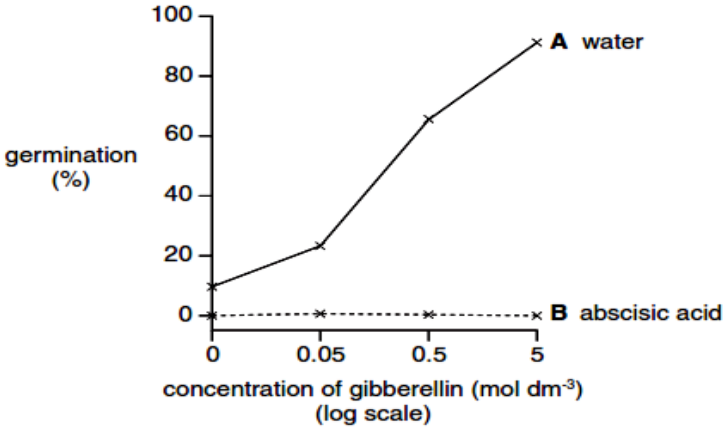
3.7.1 (a) Describe how a neurone receives communication from the adjacent neurone.

(b) What is the importance of the junctions between neurones in the functioning of the nervous system?

3.7.2 (a) Explain why plants need to be able to respond to their environment.

(b) The figure shows the results of an investigation into the effects of plant growth substances on germination.

- A large number of lettuce seeds was divided into eight equal batches.
- Each batch of seeds was placed on moist filter paper in a Petri dish and given a different treatment.
- The batches of seeds were left to germinate at 25 °C in identical conditions and the percentage germination was calculated.



(i) With reference to the figure, describe the effects of the plant growth substances on the germination of lettuce seeds.

(ii) Explain why all the lettuce seeds were kept at 25 °C.

(iii) State three variables, other than temperature, that needed to be controlled in the investigation.

(c) State two commercial uses of plant growth substances.

3.8 BEHAVIOR

3.8.1 (a) Describe what is meant by:

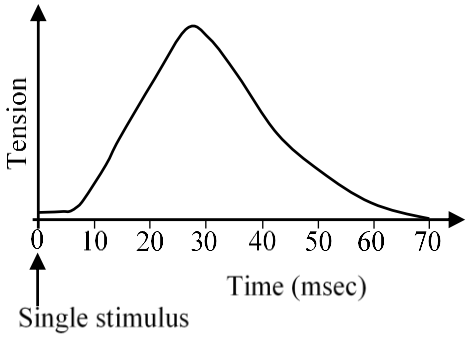
(i) Innate behaviour

(ii) Learned behaviour.

(b) Describe the advantages to animals of innate and learned behaviour, with reference to specific examples of each type of behaviour.

3.9 SUPPORT AND LOCOMOTION

3.8.1 The graph below shows the events that take place during muscle contraction



(a) Describe the effect of the application of a single stimulus on the tension of a muscle.

(b) Explain the events that take place between

(i) 0 and 5 msec.

(ii) 30msec and 70msec.

(c) Explain what would happen if

(i) Two separate stimuli were applied.

(ii) Numerous stimuli were applied.

(d) Describe the long-term biochemical effects of exercise on muscle performance.

3.8.2 (a) Describe how the following skeletal systems are adapted for locomotion in their respective habitats.

(i) Earthworm

(ii) Fish

(b) Explain the property of muscles involved in human movement.

THEME 4: CONTINUITY OF LIFE

4.1 REPRODUCTION

4.1.1 (a) How is internal fertilization responsible for the evolutionary success of mammals?

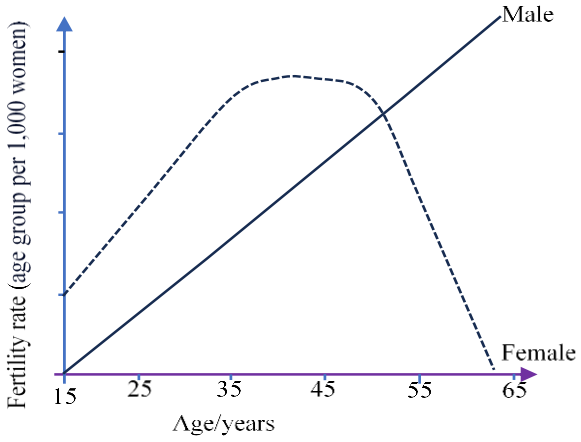
(b) Describe the events that lead to successful ejaculation in man.

4.1.2 (a) How is the gametophyte generation of ferns different from that in mosses?

(b) Describe the reproductive strategies employed by ferns for survival in their environments.

(c) State the possible causes of variation during asexual reproduction.

4.1.3 (a) The graph below shows that changes in the fertility rate of females and males in a population.



(i) Compare the fertility rate of both male and female

(ii) Explain the changes in the fertility rate of female.

(iii)From the graph, predict and explain the trend in the fertility of males above 65 years.

(iv) List any 6 causes of infertility in males.

(b) The table below shows the changes in the strength of contractions during birth with oxytocin levels.

Oxytocin Levels (pg/mL)	Strength of Uterine Contract
0 (Low)	Mild contractions
10	Moderate contractions
20	Strong contractions
30	Very strong contractions
40 (High)	Peak contractions (maximum)

(i) Explain the relationship between oxytocin levels with the strength of uterine contractions.

(ii) Describe the control of oxytocin secretion during labour.

(ii) Do actual oxytocin levels during labour follow this exact pattern for every individual?

(iv) State the three stages of labour.

4.2 GROWTH AND DEVELOPMENT

4.2.1 (a) Explain how imbibition is a critical step during seed germination.

(b) Describe the role of gibberellin hormones in promoting seed germination and seedling growth.

(c) Describe the role of light in stimulating seed germination

4.2.2 The graph in the figure I, shows changes in the respiratory quotient of pea during germination. The graph in figure II, shows the rate of intake of oxygen by dormant and non-dormant seeds.

Figure I

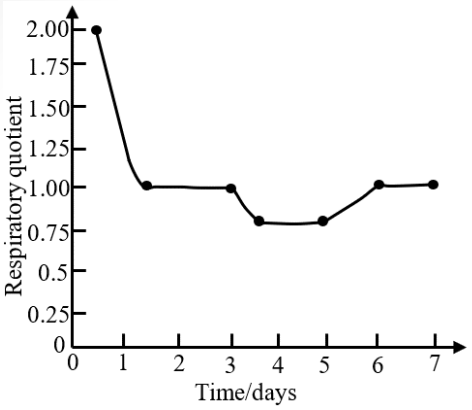
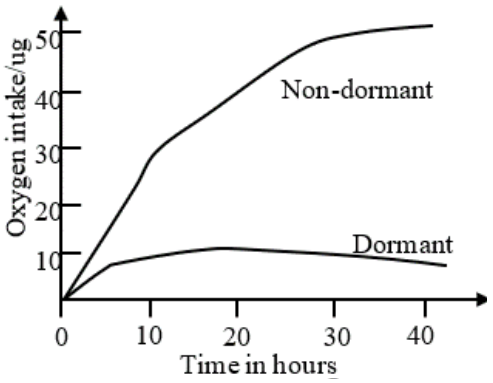


Figure II



(a)(i) Explain the changes in the respiratory quotient of pea during germination.

(ii)Why is monitoring the RQ important in the study of seed germination?

(iii) What factors can influence the RQ in germinating pea seeds?

(iv)How might a high RQ value in germinating pea seeds impact their overall growth and energy utilization?

(b) (i) Compare the rate of oxygen intake in both type of seeds.

(ii) Explain the difference in the oxygen intake in both types of seeds.

(iii) Describe what can be done to a dormant seed to make it germinate.

4.3 GENETICS AND VARIATION

4.3.1 A sex-linked gene controls fur colour in cats. Ginger-coloured fur is controlled by the allele G, and black-coloured fur is controlled by the allele g. Some cats, exclusively females are described as tortoiseshell because of having ginger and black patches of fur.

(a) Using suitable genetic symbols, workout the genotypes and the ratio of phenotypes expected in the offspring of the cross between a male cat with genotype X^gY and a tortoiseshell female cat.

(b) The effect of the G and g alleles is modified by another gene which is not sex-linked but has two alleles. The allele d changes the ginger colour to cream and the black colour to grey. The dominant allele D does not modify the effect of G or g. Using suitable genetic symbols, workout the genotypes and the ratio of phenotypes expected in the offspring of the cross between a cream-coloured male cat and black female whose genotype was X^gX^gDd to produce male kittens of two different colours.

(c) (i) With examples from humans, distinguish between sex-linked and sex-limited characteristics.

(ii) Explain why sex-linked features are more common in men than in women.

4.3.2 (a) Meiosis results in genetic variation in the gametes which leads to variation in the offspring formed by sexual reproduction. Describe how meiosis causes this variation and explain the advantage of variation to species.

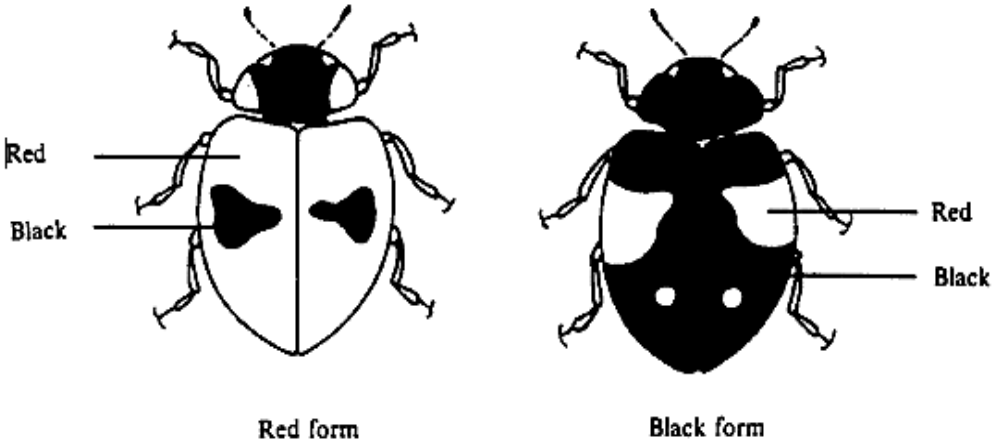
(b) An old form of wheat, emmer wheat (Triticum turgidum), has diploid chromosome number of 28 (2n=28). A wild wheat, eikom wheat (Triticum tauschii), has diploid chromosome number of 14 (2n=14). These two species occasionally crossed and produced sterile hybrid plants. Due to error in cell division, one of these hybrid plants formed male and female gametes with 21 chromosomes. Fusion of these gametes resulted in viable offspring. These plants were a new species, Triticum aestivum (2n=42), the modern bread wheat. Explain why Triticum aestivum is fertile while the majority of hybrid plants were not.

(c) Explain how major evolutionary forces lead to formation of new species?

4.4 EVOLUTION AND POPULATION GENETICS.

4.4.1 (a) 'Woolly hair' is common among Norwegian families: the hair is tightly kinked and very brittle. The allele for woolly hair (H) is dominant over that for normal hair (h). The alleles for Hand h have frequencies p and q respectively. In a certain population of1200 people, 1092 individuals have woolly hair. Assuming that the Hardy-Weinberg principle applied, calculate the frequency of occurrence of each of the genotypes HH, Hh and hh. Show all your working clearly.

(b) The two-spot ladybird exists in the two different colour forms shown in the diagram.



Red form Black form

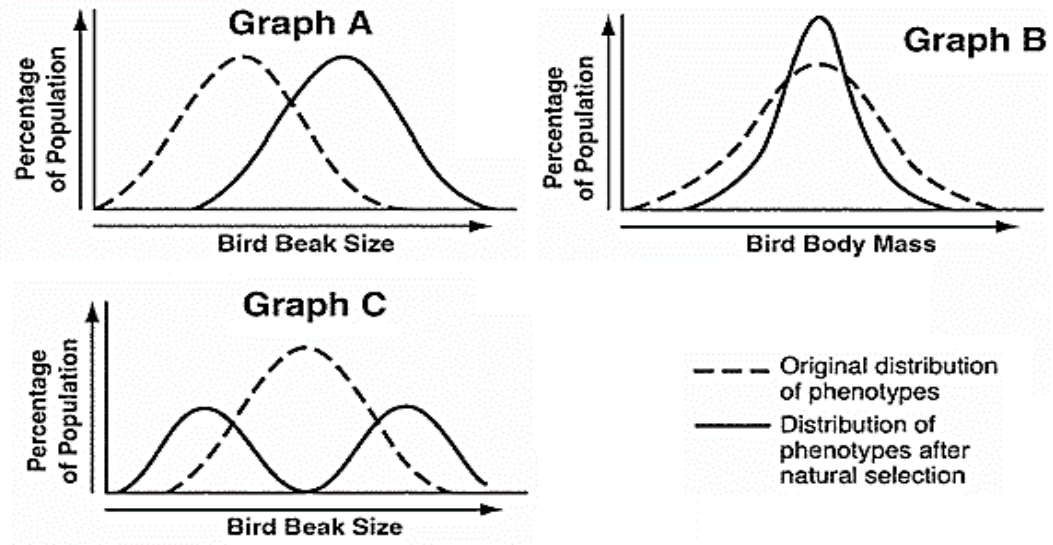
These forms are controlled by a single gene with the allele for black, B, dominant to that for red, b recessive.

Use the Hardy-Weinberg formula to predict the frequency of red and the frequency of black ladybirds in a population if the frequency of alleles Band b are the same.

(c) Outline the conditions under which the Hardy–Weinberg operates

(d) Discuss the mechanisms by which a new species may originate and a species become extinct.

4.4.2 The following graphs depict three different types of selection a population of Darwin's finches in Galapagos Island. Carefully study them to answer the questions that follow.



(a) Distinguish the effects of selection in graphs B and C.

(b) Use a likely scenario to describe how factors or conditions that may have led to the changes shown the graphs A, B and C.

(c) Explain how the following observations support the theory of evolution by natural selection.

i. Animals found on islands look similar to animals found on neighbouring islands and the closest continent.
ii. Related species will live in diverse environments in one area (for example, Africa) but can vary different from the species in similar environments in another area (for example, Asia)

THEME 5: PRACTICALS

Toad dissection

You are provided with specimen K is freshly killed.
Dissect the specimen to display
i) Blood vessels that carry blood to the left cavity organs with the heart displaced to the right.
ii) Exposed structures beneath the viscera excluding the liver lobes.
Draw and label your dissection. **(25marks)**

Cockroach Dissection

a) Using a low power microscope, examine the ventral view of the pretarsus.
(i) Describe the structure of the pretarsus (3 marks)
(ii) Draw and label the observed structures of the pretarsus including the three segments anterior to the pretarsus. (4 marks)
(b) Place the animal ventral side upper most. Draw and label the ventro-posterior end of the abdomen together with its associated structures. (3 marks)
(c) Place the specimen dorsal side upper most, cut through the left hand edge of the exoskeleton of the abdomen and dissect to expose the structures with in the abdominal region. Displace the alimentary canal to the left of the animal. Remove the unnecessary tissue to display all the parts of the alimentary canal responsible for digestion, removal of unwanted materials and structures on the dorsal cuticle anterior to **the 7th abdominal cuticle**. Draw and label your dissection. (18 marks)

Rat dissection

You are provided with specimen T which is fleshly killed.
a) Examine the hind limb and state three ways it is adapted for the survival of the specimen in its habitat. (03 marks)
b) Examine the head of the specimen and draw and label the ventral view of the anterior part of the head to show the structures for sensitivity. (05 marks)
c) Dissect the abdominal region of the specimen to expose the blood vessels.
i) Returning blood from the structures for reproduction and secretion.
ii) Supplying the structures for absorption of nutrients and excretory organs.
Draw and label (27 marks)