Association of Biology Educators (ABE)

2023 'A' LEVEL NATIONAL SEMINAR-SERIE No: 8 HELD AT DR. OBOTE COLLEGE BOROBORO, LIRA (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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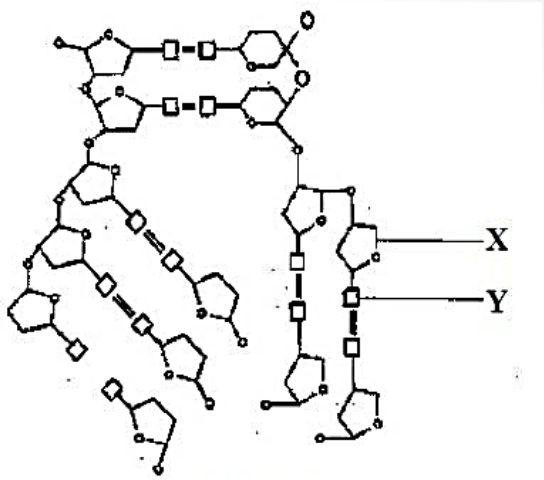
THEME 1: CELL BIOLOGY

1.1 CELL STRUCTURE AND FUNCTION



1.1.1 The figure below shows the process of DNA replication.

(a) Name parts labelled X and Y.

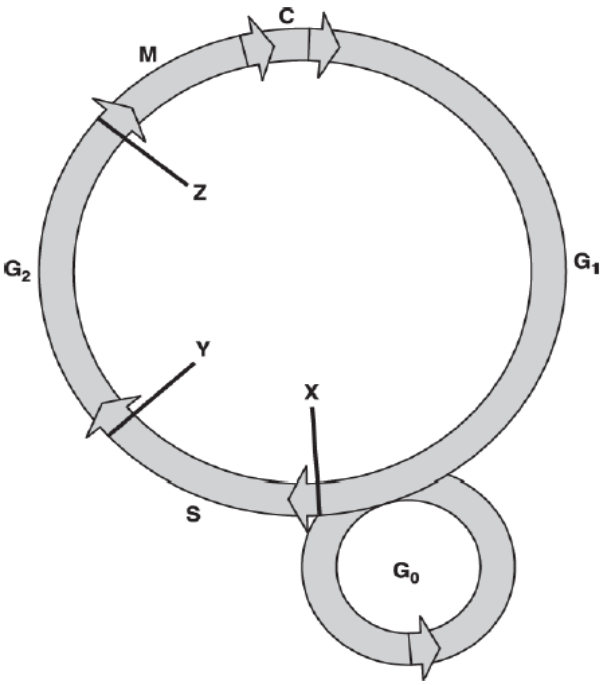
(b) Name the enzyme involved in DNA replication and state its function.

(c) Briefly explain why DNA replication is described as semi-conservative?

(d) Outline the differences between DNA replication and transcription.

1.2 CELL DIVISION

1.2.1 (a) Figure below represents the different phases of the cell cycle. **X**, **Y** and **Z** represent checkpoints in the control of the cell cycle.



(i) State all the letters that represent the **phases** of interphase.

(ii) Describe what is being checked at checkpoint X, Y and Z.

(b) The table below indicates the relative time spent in different phases of the cell cycle for three different types of cell, **P**, **Q** and **R**.

Cell type	Relative time spent in each phase			
	G_1/G_0	S	G_2	M/C
P	18	50	13	19
Q	18	25	13	16
R	100	0	0	0

(i) Which of the cells **P**, **Q** or **R** takes the shortest time to divide?

(ii) Suggest why cell **P** spends twice as much time in phase **S** than cell **Q**.

(iii) What can be deduced about the behaviour of cell **R**? Give reasons for your answer.

1.2.2 (a) (i) Describe the role performed by centrioles during cell division

(ii) Errors during meiosis result in aneuploidy, Discuss the potential causes of trisomy during meiosis and the consequences of such errors on the offspring.

(b) How does genetic recombination during meiosis contribute to genetic diversity within a population?

1.3 CHEMICALS OF LIFE

1.3.1 (a) Compare the molecular components of Adenosine triphosphate and Deoxyribonucleic acid

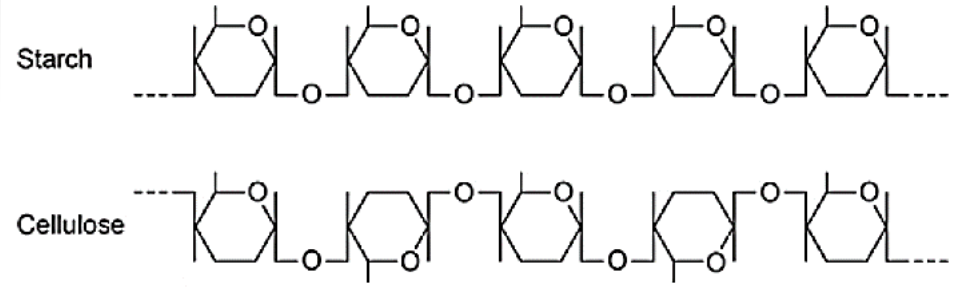
(b) Describe the chemical composition of nucleic acids. (10 Marks)

1.3.2 (a) Explain the importance of enzymes in biosystems

(b) Explain how enzymes activity is regulated in biosystems.

1.3.3 Starch and cellulose are two important plant polysaccharides.

The following diagram shows part of a starch molecule and part of a cellulose molecule.



(a) Explain the difference in the structure of the starch molecule and the cellulose molecule shown in the diagram above.

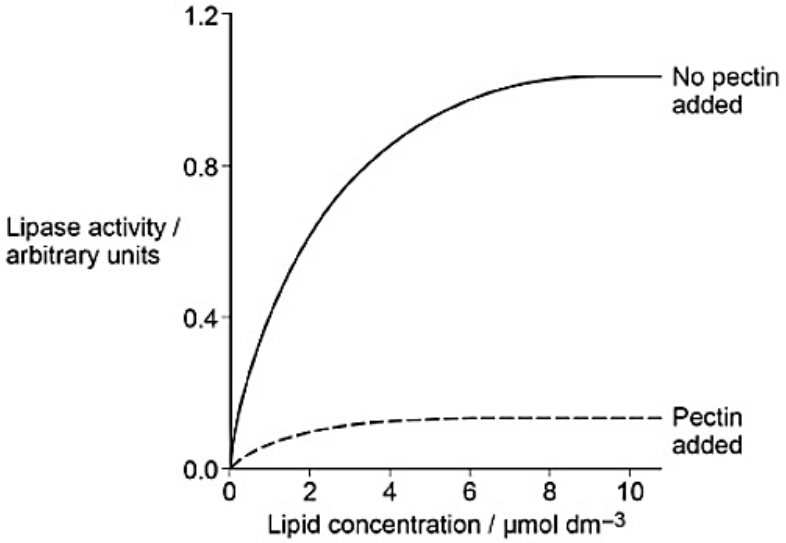
(b) Starch molecules and cellulose molecules have different functions in plant cells. Each molecule is adapted for its function.

Explain **one** way in which starch molecules are adapted for their function in plant cells.

(c) Explain how cellulose molecules are adapted for their function in plant cells.

1.3.4 (a) Describe how a **non-competitive** inhibitor can reduce the rate of an enzyme-controlled reaction.

(b) Pectin is a substance found in some fruit and vegetables. An investigation was conducted to determine the effect of pectin on the hydrolysis of lipids by a lipase enzyme. Results are shown in **figure.**



(i) Compare the lipase activity in presence and absence of pectin.

(ii) Describe and explain the activity of lipase when, pectin was added and when it was not.

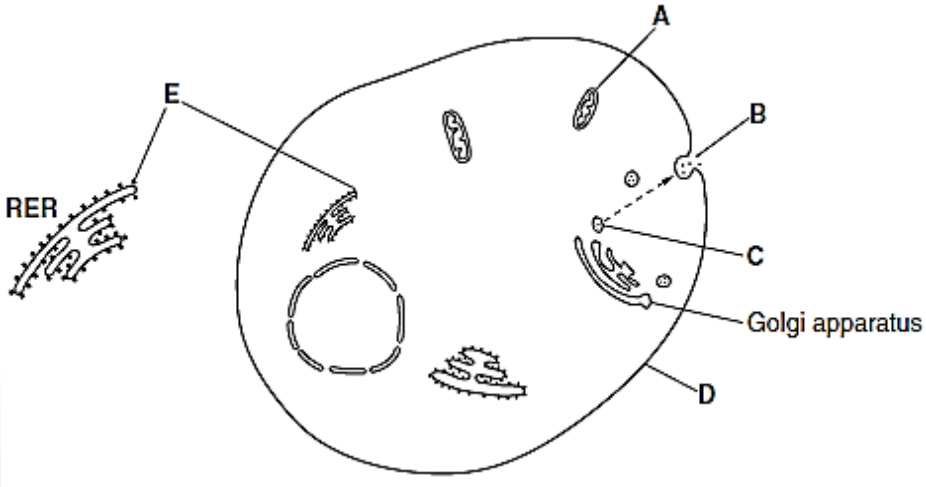
(c) A scientist measured the rate of removal of amino acids from a polypeptide with and without an enzyme present. With the enzyme present, 578 amino acids were released per second. Without the enzyme, 3.0×10^{-9} amino acids were released per second.

(i) Calculate by how many times the rate of reaction is greater with the enzyme present.

(ii) Suggest a reason for the above difference in reaction rate.

1.4 CELL PHYSIOLOGY

1.4.1 Figure below is of a cell showing organelles involved in the production and secretion of an extracellular protein. The rough endoplasmic reticulum (RER) is shown enlarged at the side of the diagram.



(a) (i) Name the structures labelled C, D and E.

(iii) Suggest one type on extracellular protein secreted at B, and its final distribution.

(b) Outline the role of the Golgi apparatus.

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(c) Explain the role of structure A in the process above.

1.4.2 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.

Figure I

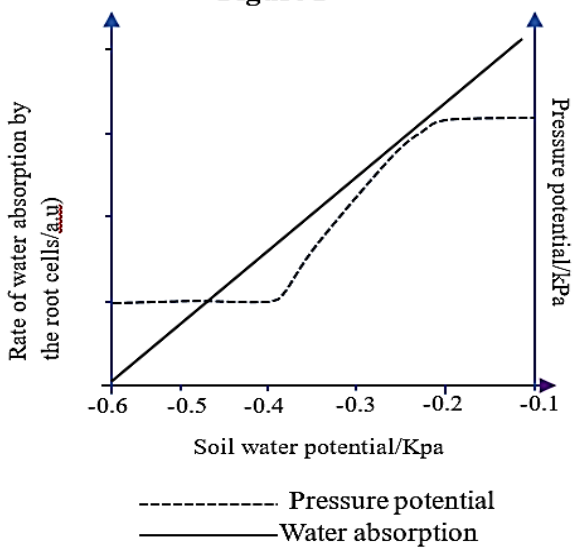
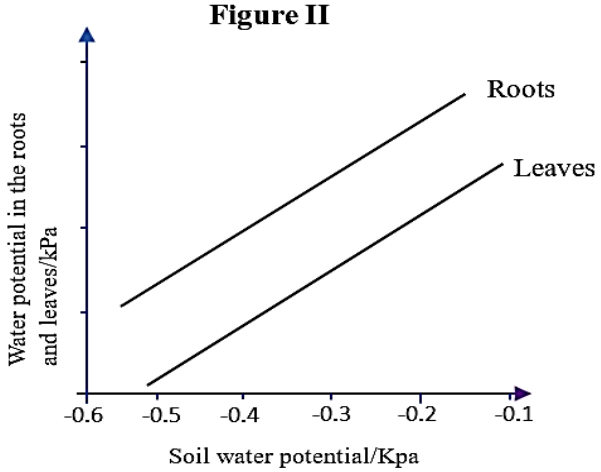


Figure II



(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 (a) Describe the structure of epithelial tissues.

(b) How are the epithelial tissues adapted for the following functions?

(i) Protection

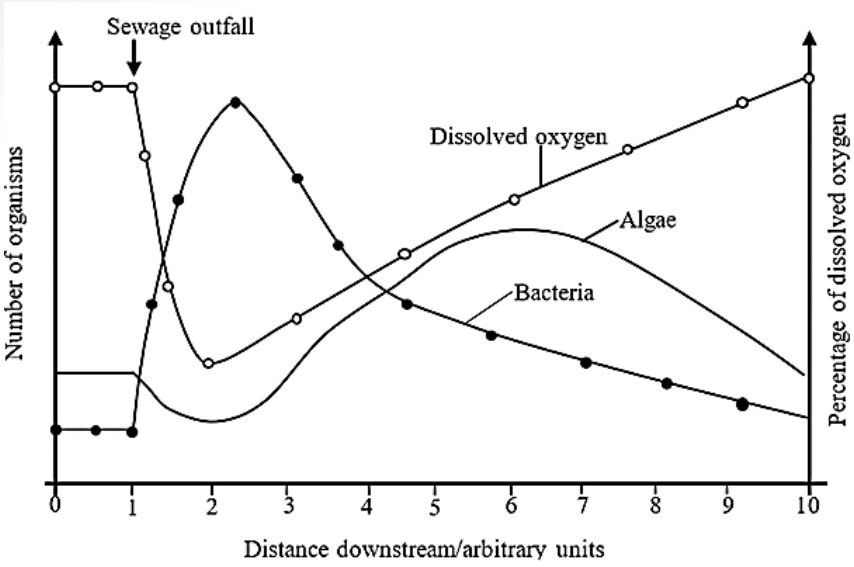
(ii) Absorption of substances

(c) Describe the different modifications of parenchyma tissues.

THEME 2: ECOLOGY

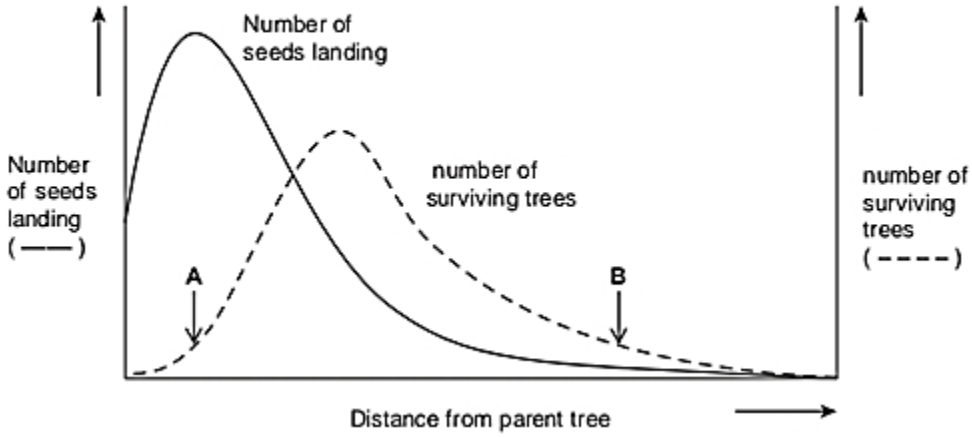
2.1 The effects of the discharge of untreated sewage on the physical and biotic factors in the lake ecosystem from the point of sewage discharge downstream were studied. The outcome of results of the study is presented in the figure below.

(a) (i) Compare the changes in the number of the two organisms downstream.



(ii) Explain the relationship in the number of organisms over the range of distance downstream.
(b) Explain the changes in concentration of dissolved oxygen,
(i) Before the discharge of sewage into the lake
(ii) From the point of sewage discharge downstream.
(c) From the figure above, determine the distance downstream where biochemical oxygen demand reaches peak. Give reasons for your answer.
(d) State factors that may offset BOD in a river
(f) Explain other chemical and biotic changes likely to occur due to the effects of the discharge of untreated sewage in the lake ecosystem.

2.2 An ecologist measured the number of seeds landing at different distances from a parent tree. He then produced then determined how the number of new trees that grew from the seeds and survived varied with distance from the parent plant. The results of the investigation are summarized in the graph below.



(a) Compare the variation in number of seedlings landing and number of surviving trees with distance from the parent plant.
(b) Suggest reasons for the number of surviving trees at points
(i) A
(ii) B
(iii) Between A and B

THEME 3: MAINTAINANCE OF LIFE

3.1 NUTRITION

3.1.1 In an investigation to study the effect of light intensity on the physiology of *Spirogyra*, its amount of Phospoglyceric acid (PGA), Ribulose bisphosphate (RuBP), and Sucrose were determined at different intervals of time in presence of light. At the 35th minute, the light was removed completely.
The graph showing the variation of the amount of PGA, RuBP, and Sucrose with time

Study the graph carefully and answer the questions that follow:

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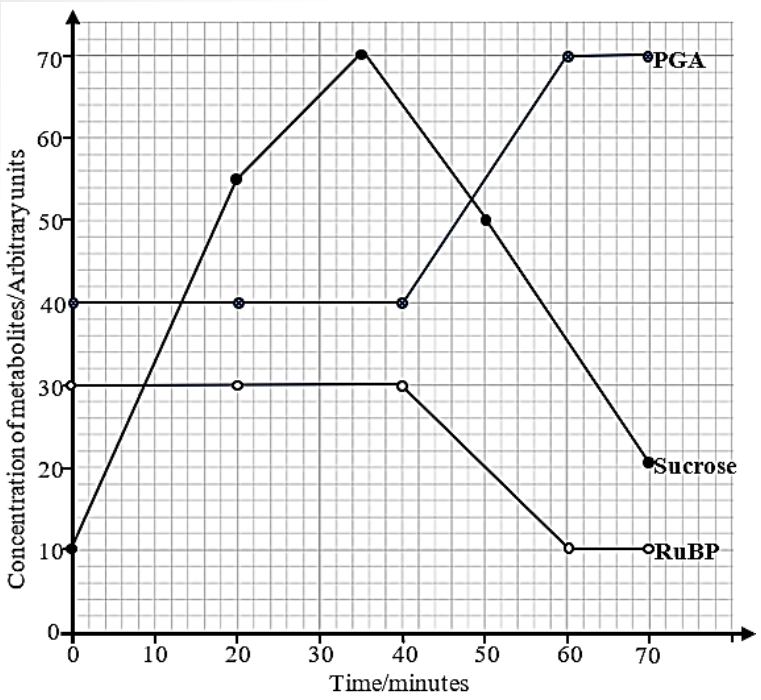
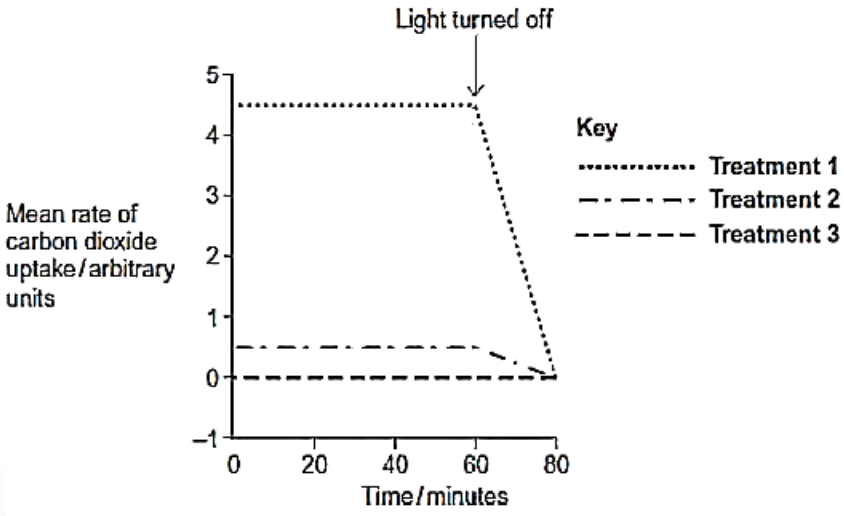


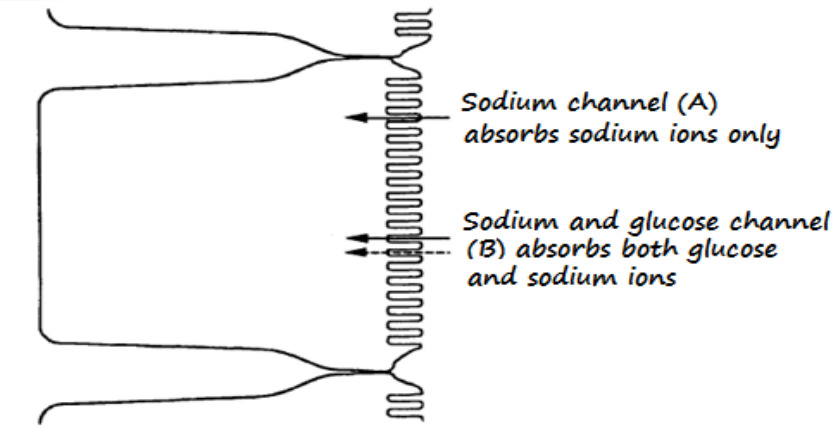
(a) Compare the amount of PGA and RUBP with time.
(b) Account for the changes in the amount of:
(i) PGA
(ii) RuBP,
(iii) Sucrose, with time
(d) Explain the changes in the amount of:
(i) PGA,
(ii) RUBP, on the sketch graph with time.
(iii) Sucrose
(d) Explain the difference in photosynthetic rate of C3 and C4 at high altitudes.

3.1.2 Scientists studied the rate of carbon dioxide uptake by grape plant leaves. Grape leaves have stomata on the lower surface but no stomata on the upper surface.
The scientists recorded the carbon dioxide uptake by grape leaves with three different treatments:
Treatment 1 – No air-sealing grease was applied to either surface of the leaf.
Treatment 2 – The lower surface of the leaf was covered in air-sealing grease that prevents gas exchange.
Treatment 3 – Both the lower surface and the upper surface of the leaf were covered in air–sealing grease that prevents gas exchange.
The scientists measured the rate of carbon dioxide uptake by each leaf for 60 minutes in light and then for 20 minutes in the dark.
The scientists' results are shown in the diagram below.



(a) Suggest the purpose of each of the three leaf treatments.
(b) Describe and explain the results shown in the Treatment 1.
(c) The stomata close when the light is turned off. Explain the advantage of this to the plant.
(d) In treatment 2, uptake of carbon dioxide continues even when the lower surface of the leaf is sealed. Explain.
(e) In both treatment 1 and 2, uptake of carbon dioxide falls to zero when the light is turned off. Explain why?

3.1.3 The epithelial cells of the intestinal villi absorb sodium ions in two different ways. These are shown in the diagram.



a) Explain how blocking of the sodium channels (A) might lead to diarrhoea.

Standard oral rehydration therapy involves giving the patient a mixture of glucose and salts having approximately the same solute concentration as blood.

Several ways have been investigated of making oral rehydration therapy more effective.

c) Suggest why:

i) Adding extra glucose to the mixture would be unwise;

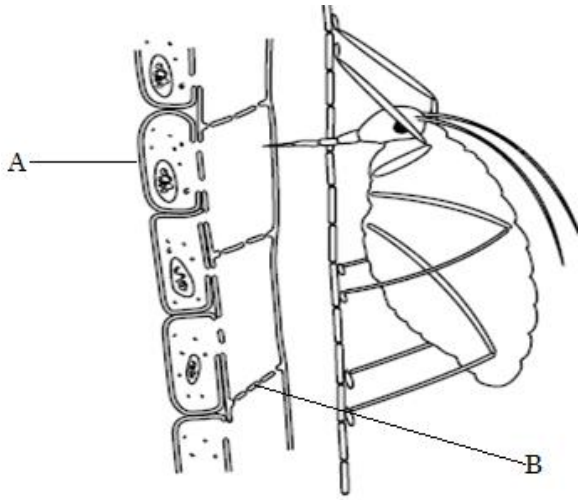
ii) Using a mixture of starch and salts reduces the extent and duration of the diarrhoea even more.

d) With reference to a named carnivorous mammal describe how (i) protein is digested and absorbed into the bloodstream and (ii) the products are assimilated.

3.2 TRANSPORT

3.2.1 Figure below shows an aphid feeding from a plant stem. The aphid feeds by inserting its tube-like mouth parts into the tissue section that transports sugar solution. Some details of this transport tissue are shown in the vertical section.

The table below shows results of a classic investigation of the effect of temperature on rate of sugar transport in a potted plant. Aphid mouth parts were used to take samples of sugar solution from the transport tissue in the stem. The sugary solution dripped from the mouth parts. The number of drips per minute was counted. The procedure was repeated at different temperatures.



temperature (°C)	number of drips per minute
5	3
10	6
20	14
30	26
40	19
50	0

(a) Identify A and B, described how A is suited for function.

(b) Describe how active loading takes place into the above transport tissue.

(c) Suggest brief explanation for the results in the table above.

(d) Predict with a reason, what would happen to the number of drips per minute between 5 and 26 minutes if the stem was injected with potassium cyanide?

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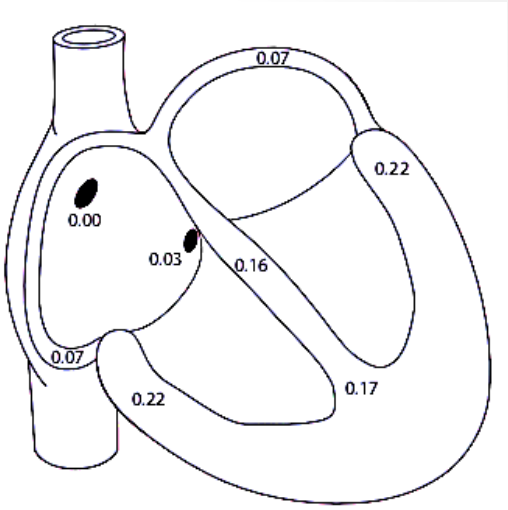
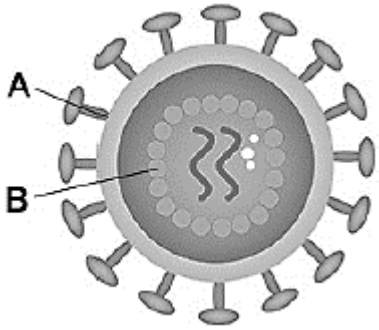
3.2.2 The diagram shows the time taken in seconds for an impulse to travel through the human heart.



(a) Analyze the information in the diagram and explain how the times shown in the diagram relates to the cardiac cycle.
(b) The mean heart rate of this heart was 72 beats per minute. Calculate how long the ventricles are relaxed during one cardiac cycle.
(c) Explain the factors that affect heart beat rate.

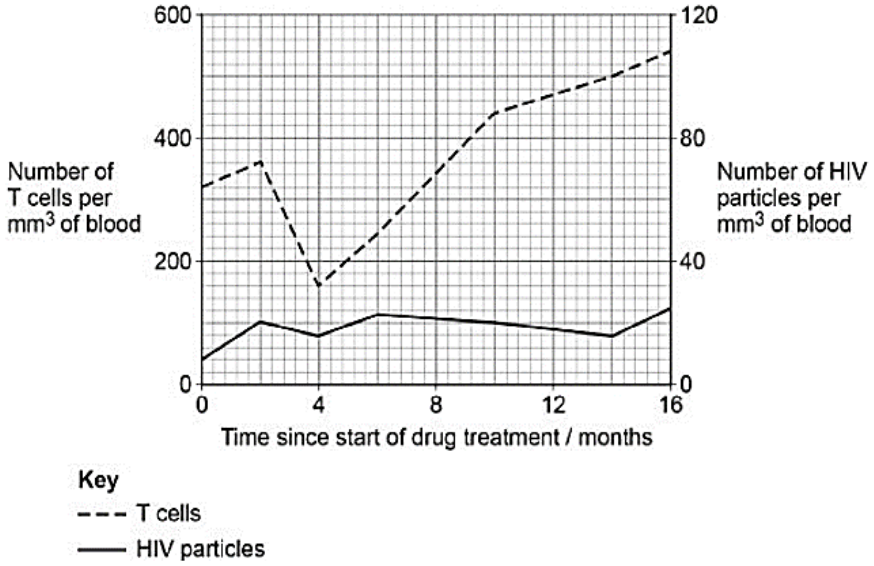
3.3 DEFENCE AGAINST DISEASES

3.3.1 (a) The diagram below shows the structure of the human immunodeficiency virus (HIV).



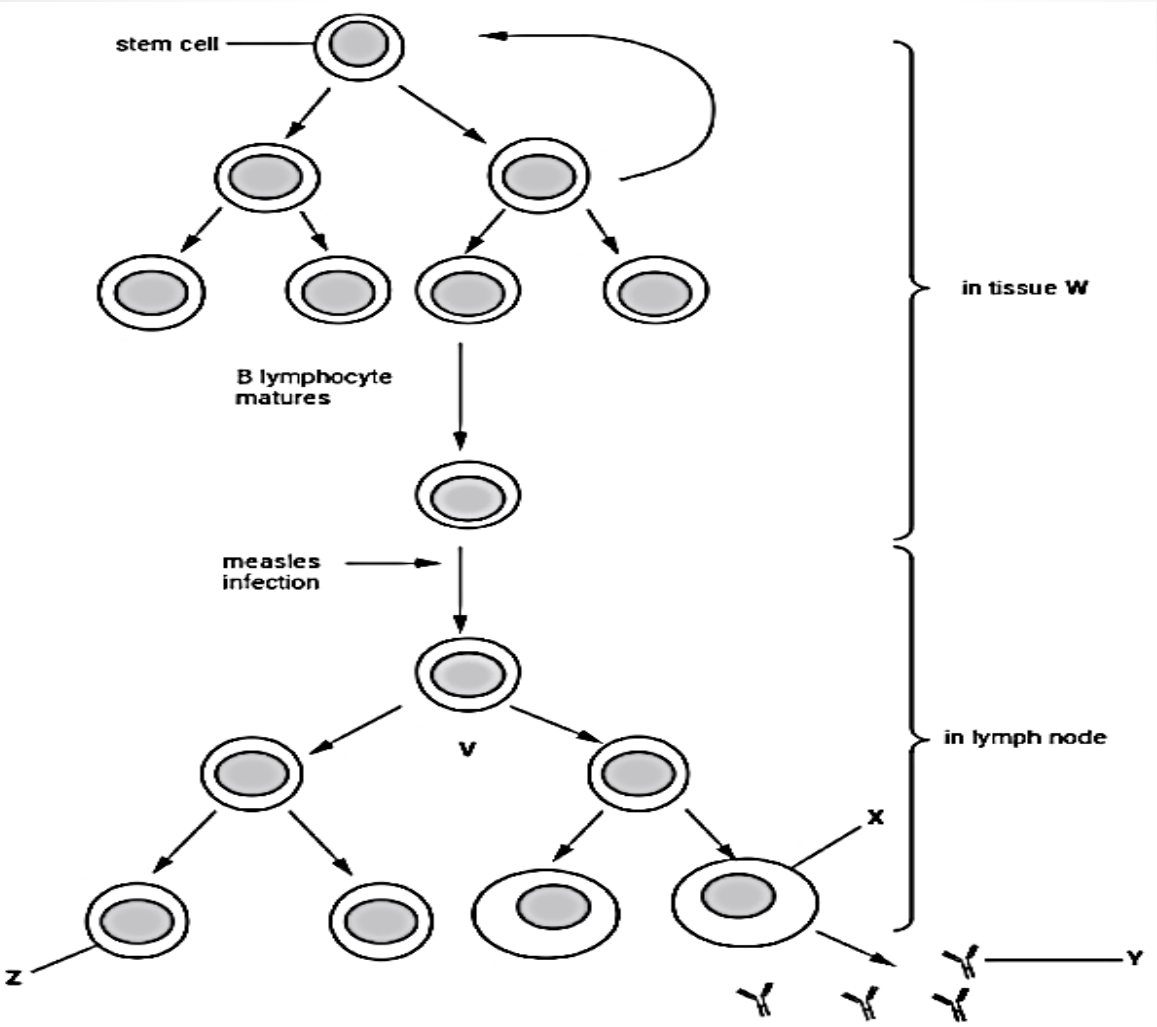
(i) Name structures **A** and **B**, and give their function.
(ii) Describe how HIV is replicated.
(iii) Explain features that make HIV a successful pathogen.

(b) The graph below shows the effect of a drug on the number of T cells and the number of HIV particles in blood taken from a person with AIDS.
Symptoms of AIDS occur when the number of T cells is below 200 cells mm-3



(i)Compare the number of T cells and number of HIV particles in blood over the 16 months period.
(ii) Explain the changes in the number of T cells and number of HIV particles over the 16 months.
(iii) How effective is the drug used in treating HIV? Explain.

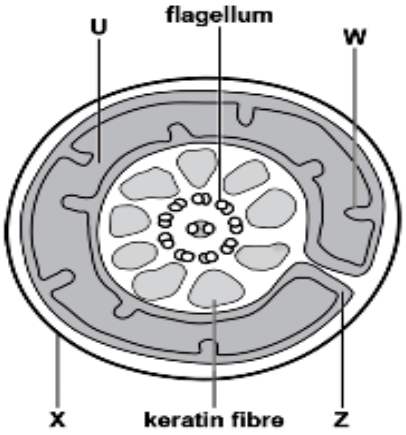
3.3.2 The figure shows the origin and development of a B lymphocyte and its subsequent role in an immune response following an infection with the measles virus.



(a) Name the;
(i) Cell V
(ii) Tissue W
(iii) Cell X
(iv) Molecule Y
(v) Molecule Z
(b) With reference to the figure above, describe what happens when the immune system invades the immune system.
(c) How different is the role of B lymphocyte from T lymphocyte in the immune response.

3.4 RESPIRATION

3.4.1 The figure below shows a transverse section of a sperm cell. The mitochondria of sperm cells form a spiral around the central flagellum. The table shows how the production of ATP, FADH2 and hexose 1,6-bisphosphate in sperm cells is affected by three different substances.



Substance	Organic products of respiration per sperm cell		
	ATP (10^{-10} mols^{-1})	$FADH_2$ (10^{-11} mols^{-1})	Hexose 1,6-bisphosphate (10^{-11} mols^{-1})
Cyanide	2.54	0.00	5.78
Fluoride	0.00	0.00	0.00
Sucrose	6.89	2.53	5.42

a) (i) Identify the structures labelled with the following letters: U, W, Z.
(ii) What can be concluded about the difference between the effects of cyanide and fluoride on respiration in sperm?

(b) Describe the production of ATP by substrate-level phosphorylation in different stages of respiration with reference to the number of ATP molecules produced.

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3.4.2 One of the main sources of commercial sugar is the sap from palm tree, *Borassus flabellifer*. Yeasts and bacteria, however, can contaminate the sap as it is collected and ferment the sugar, producing ethanol, making it less suitable as a source of sugar.
A study was carried out to investigate the effect of three treatments traditionally used to reduce fermentation during the collection of the sap. The sap is treated in one of the following ways:

- With a weak alkaline solution (treatment A).
- With bark from the tree, *Vateria copallifera* (treatment V).
- With bark from the tree, *Careya arborea* (treatment C).

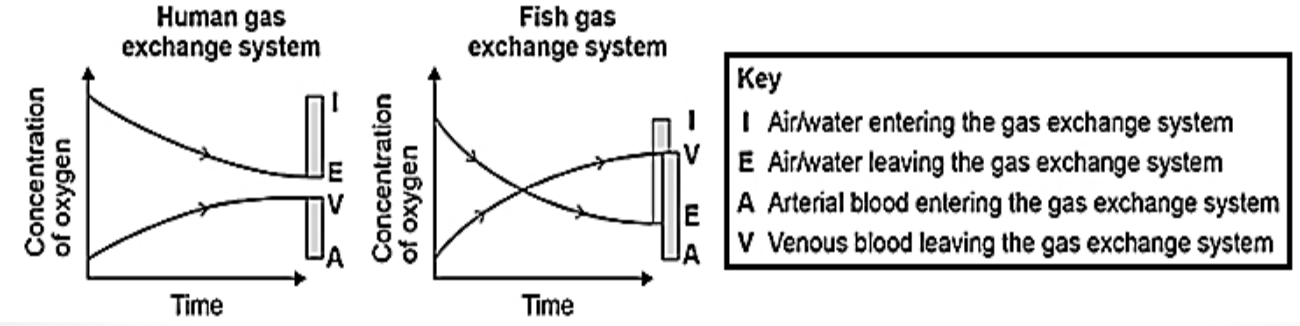
The sap was collected from the palm trees over a 60-hour period. Samples of the collected sap were taken at 15 hour intervals. In each sample, the concentration of alcohol and the number of bacteria were recorded. The results are shown in the figure below.

Treatment	Sample time (hours)	Alcohol concentration (%)	Number of bacteria ($10^6 cm^{-3}$)
Control (no treatment)	15	0.2	19
	30	3.5	800
	45	5.2	2200
	60	2.6	3400
A	15	0.0	3
	30	0.1	4
	45	0.2	5
	60	0.3	7
V	15	0.2	110
	30	1.1	2900
	45	1.2	2400
	60	1.8	2000
C	15	0.4	230
	30	1.1	160
	45	1.3	3
	60	3.6	40

(a) With reference to the figure, describe the effect of the different treatments on the alcohol concentration of the treated samples compared with the control samples.
(b) Explain the effect of the different treatments on the alcohol concentration of the treated samples.
(c) Suggest, with reasons, which of the treatments shown in the figure would be the best for use with sap so that it is suitable as a source of commercial sugar.

3.5 GASEOUS EXCHANGE

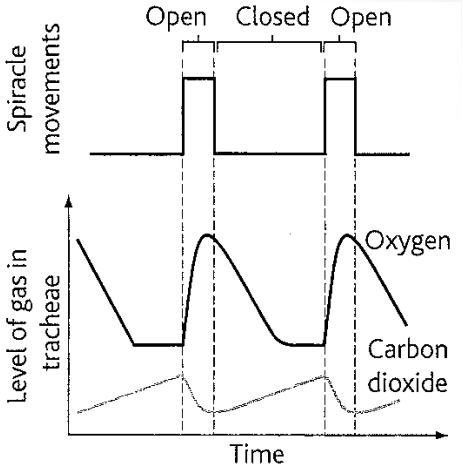
3.5.1 Figure shows changes in concentration of oxygen in two gas exchange systems.



(a) From the figure above, state the most efficient gas exchange system. Suggest reasons for your answer.

(b) Explain how the counter-current principle allows efficient oxygen uptake in the fish gas exchange system.
(c) Explain why death of alveolar epithelium cells reduces gas exchange in human lungs.
(d) Describe the pathway taken by an oxygen molecule from an alveolus to the blood.

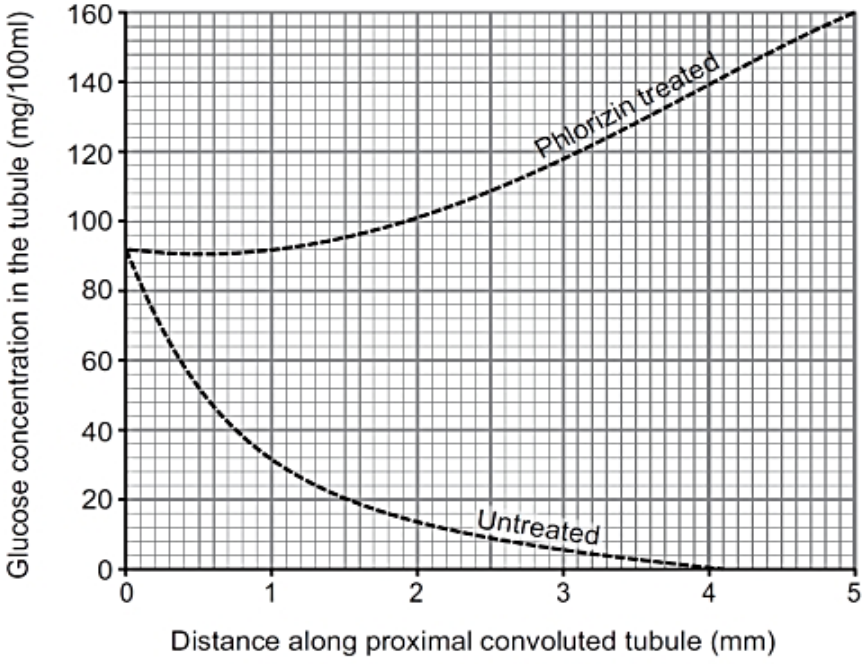
The figure below shows results of an experiment which measured the levels of oxygen and carbon dioxide in the tracheal system of an insect over a period of time. During the experiment, the opening and closing of the insect's spiracles was observed and recorded.



(e) Describe the pattern of level of gases in tracheae in relation to spiracle movements.
(f) Explain the pattern of level of gases in tracheae in relation to spiracle movements.
(g) (i) From the information provided by the graph, suggest the causes of spiracle opening.
(ii) What is the advantage of the observed spiracle movements to a terrestrial insect?

3.6 HOMEOSTASIS

3.6.1 The proximal convoluted tubule of the kidney nephron selectively reabsorbs glucose and sodium ions into the surrounding blood capillaries. The uptake of glucose from the lumen of the tubules can be prevented completely by introducing a chemical phlorizin. The graph below shows the concentration of glucose as the filtrate passes along the tubule.



(a) Calculate the percentage change of glucose in the tubule from 0 to 4mm in the nephron treated with phlorizin.
(b) Compare the levels of glucose in treated and untreated nephron.
(c) Explain the effect of phlorizin on glucose reabsorption from the filtrate.
(d) How is the proximal convoluted tubule adapted to performing its function?

3.6.2 The figures below show the rates of metabolism and heat loss by evaporation in two different vertebrates as environmental temperature changes.

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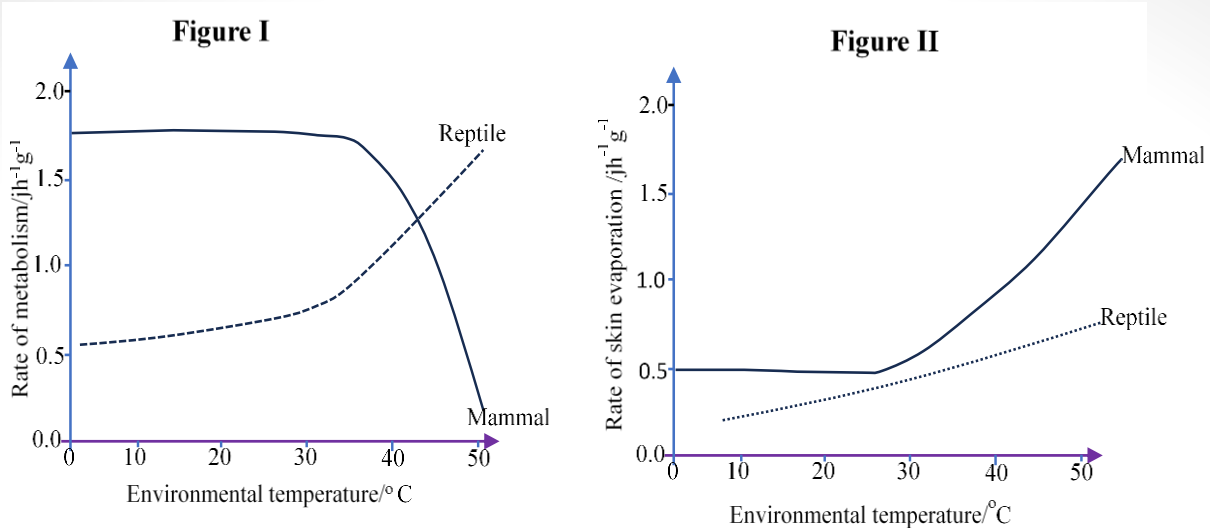


(a) (i) Compare the trends in the rate of metabolism in the mammal and reptile with changes in the changes in the environmental temperature.

(ii) Explain the variation in the rate of metabolism of the mammal with changes in the environmental temperature.

(b) Explain the effect of increase in environmental temperature on the rate of skin evaporation in

(i) Mammal

(ii) Reptile

(c) (i) From the information provided suggest, state the advantages a mammal has over the reptile in temperature regulation.

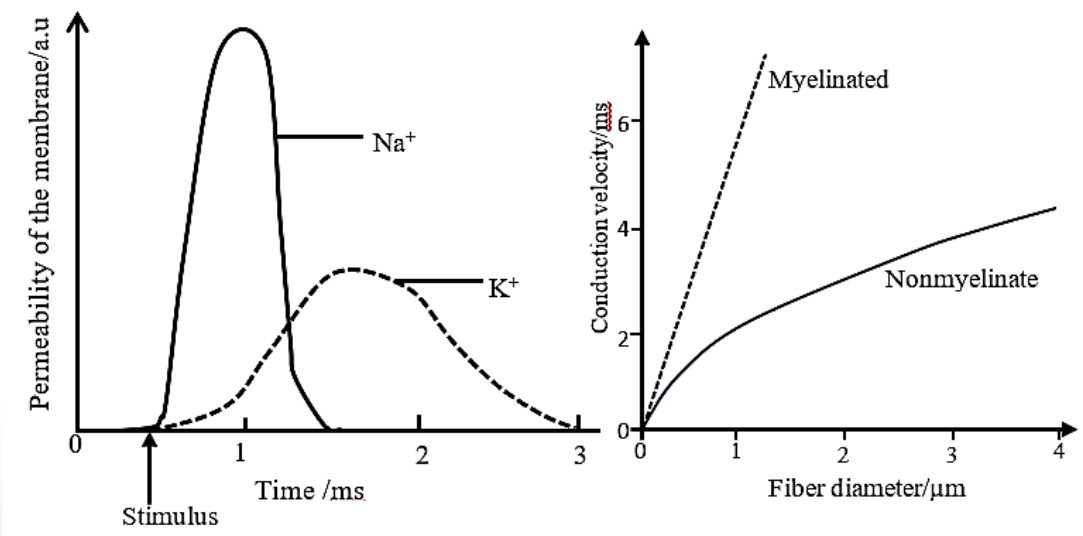
(ii) From the graph, predict and explain what would happen to the rate of evaporation of from the skin surface in a mammal when temperature exceeds 50^0C to 90^oC.

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 The graph shows the changes in the permeability of the surface membrane of an axon to sodium and potassium ions during an action potential.



(a) (i) Compare the permeability of the membrane to both sodium and potassium ions.

(ii) Describe the effect of the application of a stimulus on the membrane permeability of soidium ions.

(b)Explain the effect of the application of a stimulu on the permeability of both sodium and potassium ions.
(c) (i) Explain the effect of increase in the fibre diameter on the conduction velocity.
(ii) Explain the observed difference in the conduction velocity of mylinated and nonmyelinated fibre.
(iii) Uing the information provided by the graph, explain why nonmyelinated axons have a larger diameter than myelinated axons
3.7.3 (a) How is the arrangement of receptor cells on the retina improves vision?
(b) (i) Describe the events that occur when light strikes to rod to the formation of impulses in the optic nerve fibre.
(ii) How is the eye of an insect adapted to perform its functions?

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

3.9.1 In an experiment to investigate muscle contraction,

- Six thin strips of fresh skeletal muscle tissue were cut to similar lengths, and each strip was placed on a white tile together with some buffer solution.
- The initial length of each strip was measured using a ruler.
- A small volume of a test solution was added to each strip of muscle and after five minutes, the final length of each strip was measured.

The results are shown in the Table below.

	Test solution added					
	Unboiled ATP ($mgdm^{-3}$)				**Boiled ATP ($mgdm^{-3}$)**	**Glucose(gdm^{-3})**
	1.0	0.50	0.25	0.10	1.0	0.10
Initial length(mm)	40	39	39	40	39	41
Final length (mm)	28	29	32	36	28	41

(a) Work out the percentage change in length of each strip and fill your results in the Table.
(b) On a suitable graph, represent the percentage change in length results for the six test solutions.
(c) Explain the effect of adding the following test solutions on the percentage change in length of the strips.
(i) Different concentrations of unboiled ATP.
(ii) Glucose solution
(d) Suggest an explanation for the difference in results when boiled ATP solution was added to a muscle strip and when unboiled ATP was added to a muscle strip.
(e) Describe how the structure of the skeletal muscle relates to its function.

THEME 4: CONTINUITY OF LIFE

4.1 REPRODUCTION

4.1.1 (a) (i) Describe the events of hormonal secretions and effects during birth.

(ii) With examples, describe the effects of drugs on the developing embryo.

(b) How can vaginal infections reduce female fertility?

4.1.2 The graph in the figure below shows how the plasma concentration of oestrogen and thickness of the endometrium vary during a woman's menstrual cycle.

(a) Describe the changes in the plasma concentration of oestrogen hormone.

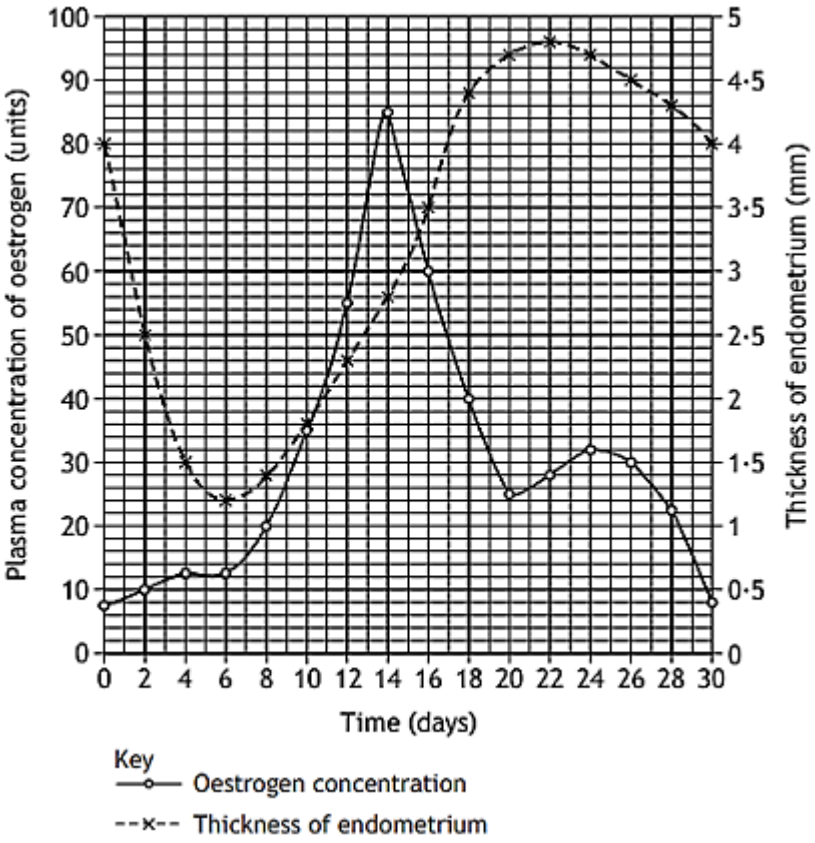
(b) Account for the changes in the thickness of endometrium over the 30-days period.

(c) Explain

(i) What would happen if fertilization had occurred on the 22nd day of the month?

(ii) How the relationship between oestrogen and luteinizing hormone is an example of positive feedback.

(d) Describe how oestrogen may act as a contraceptive.



4.1.2 (a) Describe the process that occurs during the production of a pollen grain in the anther of a flowering plant until the mature grain is exposed to a visiting pollinator.

(b) By what means may pollen grains be prevented from reaching the receptive stigma of the same flower?

4.2 GROWTH AND DEVELOPMENT

4.2.1 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

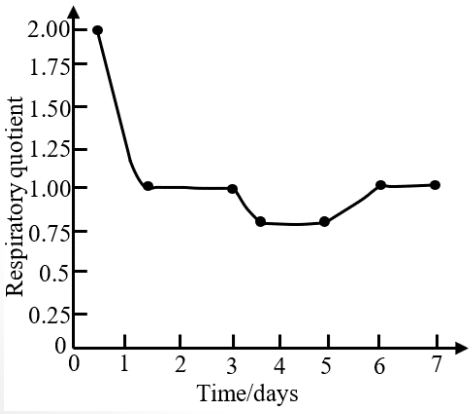
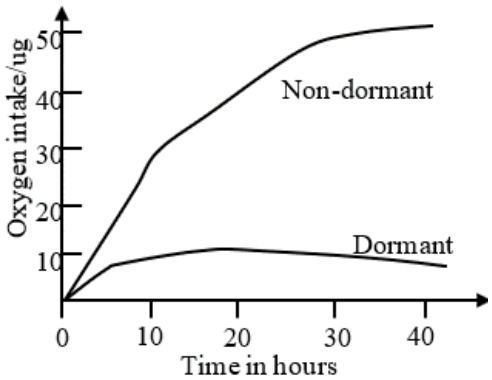


Figure II



(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.

4.2.2 (a) What is the role of the apical meristem in root growth?

(b) (i) Describe the role played by the cork cambium in the formation of a lenticel.

(ii) Describe the functions of lenticels on the stem.

4.3 GENETICS AND VARIATION

4.3.1 (a) Errors during meiosis result in aneuploidy, Discuss the potential causes of trisomy during meiosis and the consequences of such errors on the offspring.

(b) How does genetic recombination during meiosis contribute to genetic diversity within a population?

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 The results in table below shows mosquito resistance to DDT. Mosquitoes were considered resistant to DDT if they were not killed within 1 hour of receiving a dose of 4% DDT.

Month	0	8	12
Mosquitoes Resistant to DDT	4%	45%	77%

a) Suggest explanations for the results obtained,

i. On first spray.

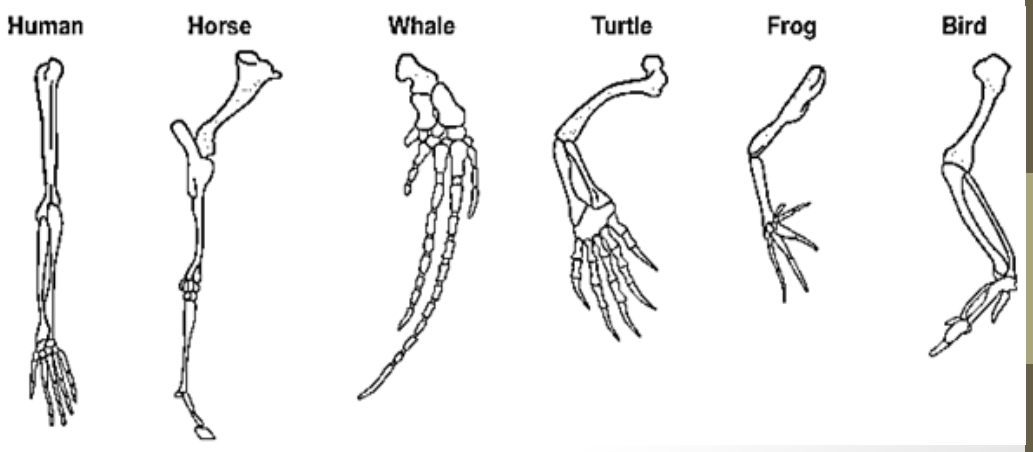
ii. On the 12th month.

b) How would the knowledge of selection pressure be used to reverse the results obtained on the 12th month?

c) Explain how resistance to DDT by mosquitoes provides evidence for evolution.

d) Bacteria undergo microevolution due to antibiotic resistance, Explain how this occurs.

4.4.2 Figures below show the skeletal structure of the front/ fore limbs of 6 animals: human, horse, whale, turtle, frog and bird. Each animals has a set of bones.



a) For each animal, state the type of movement(s) each limb is responsible for.
b) State the structural and functional differences between each and that of the human arm
c) How do the structural features provide evidence for evolution?

4.4.3 The African elephant uses its trunk to reach for vegetation and suck up water for drinking and bathing, it has large ears to help keep it cool by giving off heat, and it has tusks for foraging, digging, stripping bark off trees.

(a) Use Lamarck's theory to explain how the African elephant evolved its trunk.

(b) Darwin suggested a different theory for the evolution of characteristics. Give an outline of Darwin's theory of evolution of characteristics. Use the example of the development of elephant's large ears.

THEME 5: PRACTICALS

Toad dissection

You are provided with specimen K is freshly killed. Dissect the specimen to display

a) Blood vessels that carry blood to the left cavity organs with the heart displaced to the right.

b) 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)

DISCLAIMER.

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