Association of Biology Educators (ABE)

2023 EDITION 'O' LEVEL NATIONAL SEMINAR-SERIE No: 7 HELD AT NGORA HIGH SCHOOL, NGORA (U) ON THE SATURDAY 30TH SEPTEMBER, 2023

This write up is a high school 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. ***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.*

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FOREWORD

Biology revision can be a daunting task, but it doesn't have to be. The **Association of Biology Educators** (ABE) has simplified Biology revision through seminars, where expert guidance, as well as sample questions and answers are discussed.

Biology Revision Tips

Whether you are a student preparing for exams or an adult looking to brush up on your skills, this work can help you achieve your Biology goal.

- First, set your Biology goal. What distinction or credit do you aim to score in Biology? Do you know the marks needed to score each distinction or credit?
- Next, create a revision plan. During which hours will you be revising Biology per day or in a week? Manage your time effectively - draw a revision time table with Biology placed in favorable hours when your brain is fresh. Strictly follow your Biology reading time table, no matter what!
- Then, collect materials, read them, answer questions and mark yourself using the answers. Balance all topics, from **S.1** to **4**. Sources of questions include textbooks, newspapers and past exam papers.
- Beware that marks from two papers make your final grade. For paper 1 (553/1), spend more time practicing Section **B** and **C** questions. For practical (paper 2/ 3), pay special attention to drawings, food tests and features for classification, including biological keys.
- Lastly, where you find difficulty, discuss with classmates or approach your teachers for further guidance.

How to use this work

You can read this work from cover to cover, or you can dip in and out of the different topics as needed. If you are a student preparing for exams, I recommend that you 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!

Frederick Dongo-Shema. *President, ABE*

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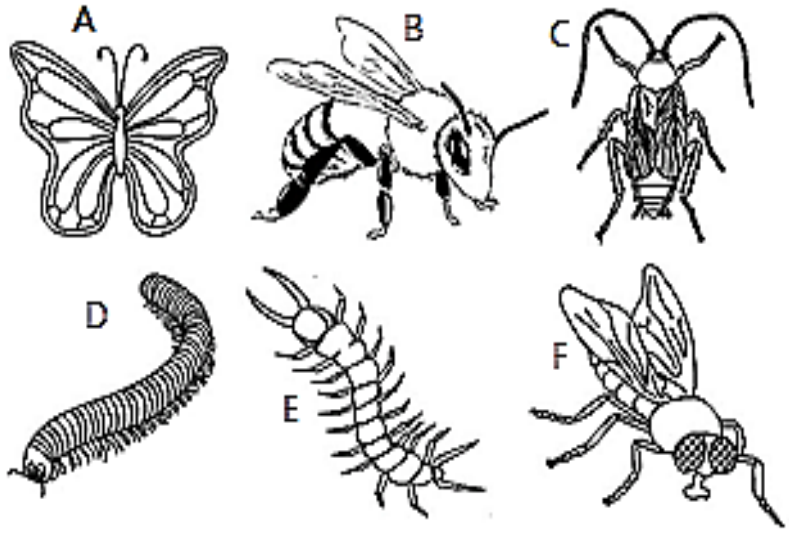
CLASS: S.1 TOPIC 1: DIVERSITY OF LIVING THINGS

1.1 Classification

1.1.1 (a) State the specific functions of the named tissues and organs in animals and plants.

(b) How do these hierarchical levels of organization contribute to the survival and adaptation of organisms?

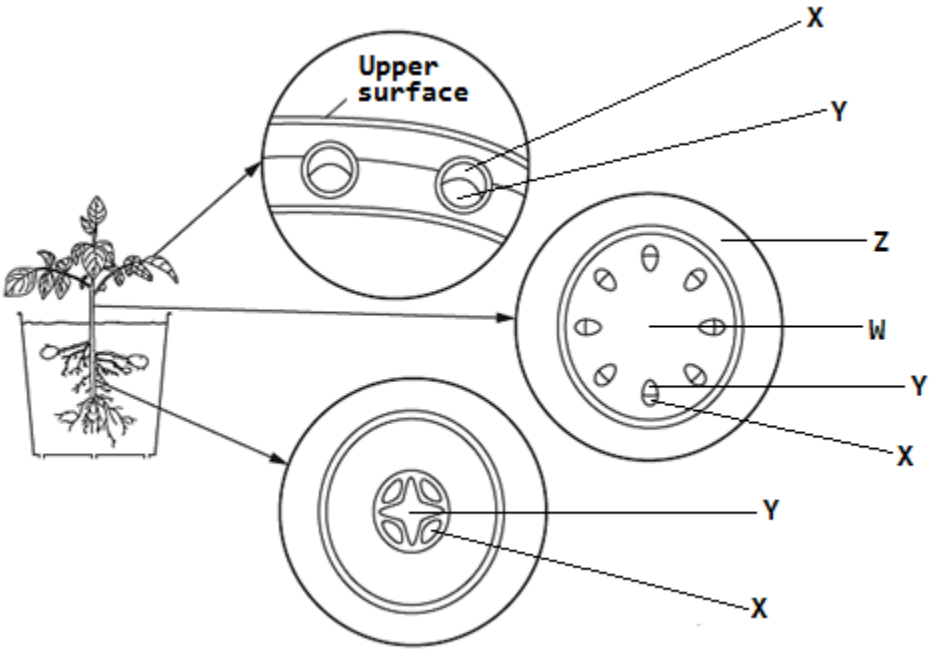
1.1.2 Examine the arthropods in the drawings below.



(a) Compare the structures of the arthropods shown.
(b) What characteristics do insects have because they are a type of arthropod?
(c) With reasons, identify the specimens that belong to class insecta.
(d) From the structures examined, construct a possible dichotomous key for the arthropods

1.2 Flowering plant structures

1.2.1 Figure shows a diagram of a dicotyledonous plant. The arrows point to circles containing magnified cross-sections of those parts of the plant.



(a) Name parts labelled **W, X, Y** and **Z.**
(b) Give the functions of parts **X**, **Y** and **Z**.
(c) Compare the structures in stem cross section and that of a monocotyledonous stem cross section.

(d) Apart from the structures in the magnified cross sections, what other two observable features on the plant can be based on to classify the plant as a dicotyledonous plant.

1.2.2 (a) Giving an example in each case, Describe the function of specialized cells in plants and any named vertebrate.

(b). Describe how stems are modified to perform other functions other than conducting materials within the plants and making food for the plant.

1.3 Insect Features, Life Cycles and Economic Importance

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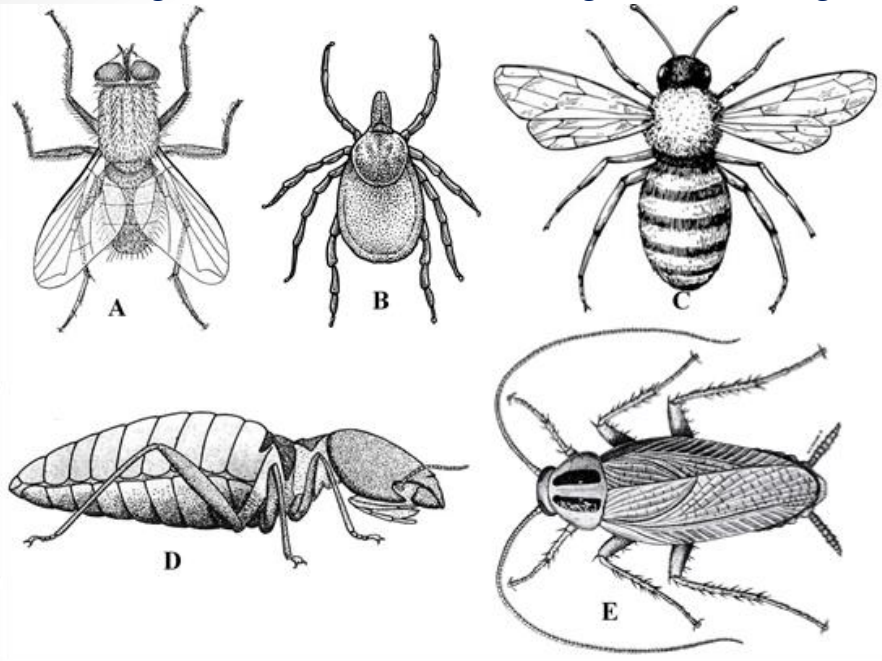
1.3.1 The figure below shows the different organisms in the kingdom animalia.



(a) (i) How is specimen E adapted to its mode of life?
(ii) How is specimen A adapted to the spread of disease-causing germs?
(b) (i) State any three similarities between specimen A and specimen C.
(ii) How is specimen A different from specimen B?
(c) Using the specimens shown, construct a dichotomous key to identify the organisms.

CLASS: S.2 TOPIC 2: SOIL

2.1 Soil Fertility

2.1.1 (a) explain the relationship between soil fertility and the availability of air and water to plants.

(b) How can soil conservation practices enhance soil fertility, and why is this crucial for agriculture and ecosystems?

2.1.2 (a) Explain why dead plants decompose very slowly in a wet ground.
(b) Describe the processes by which:
(i) Dead material is converted into nitrates.
(ii) Nitrogen compounds are converted into free nitrogen.
(c) Suggest why insectivorous plants, like the Venus flytrap survive in very wet ground, such as bogs.

2.1.3 A student investigated the water content of some soils and recorded the following results.

Soil sample	Mass of soil and dish drying (g)	Mass of soil an after drying (g)	Change in mas
A	126	125	1
B	128	124	4
C	132	127	5
D	136	130	6
E	131	128	3

(a) Describe the procedure the student used to obtain the results of soil sample A.
(b) Giving reason, identify the soil sample which contains the most water.
(c) Predict the type of soil sample A, giving a reason for your answer.
(d) Describe how the student would proceed to determine the percentage of humus in soil sample E.

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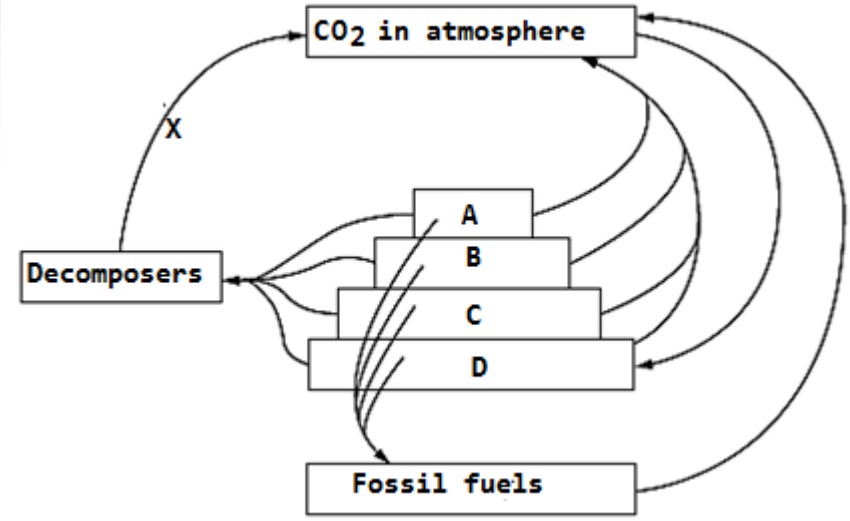
2.2 C, N, Water cycles

2.2.1 The figure below shows a pyramid of biomass and part of the carbon cycle.



(a) (i) State the principal source of energy required for trophic level **D** of the pyramid of biomass in the figure above.

(ii) State how carbon is transferred from **D** to **C**.

(iii) Explain why trophic level **A** is smaller than trophic level **B** in the pyramid of biomass.

(b) Arrow **X** on the figure indicates transfer of carbon from decomposers to the atmosphere.

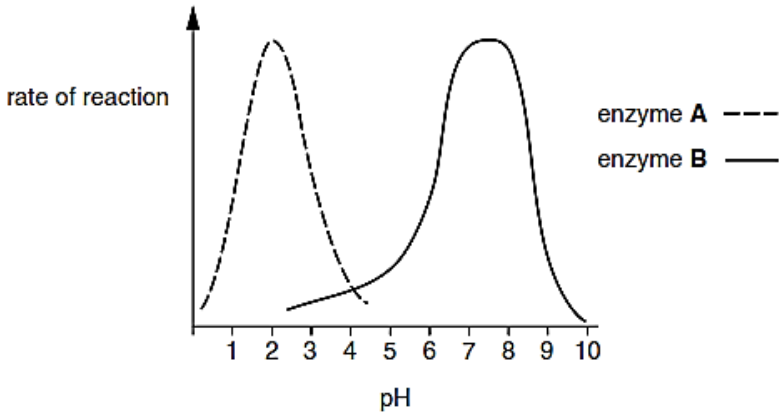
(i) State two examples of decomposers.

(ii) Name process **X**.

(c) Describe how human activities are affecting the carbon cycle.

CLASS: S.2 TOPIC 3: NUTRITION

3.1 The Figure below shows the activity of the enzymes, A and B, at different pH levels.



a) From the graph, describe the trend for each enzyme.

b) Identify each enzyme in the human body, and give a reason.

c) Describe the conditions in the human body that allow each enzyme to work effectively.

3.2 The Figure provided shows the results of some food tests.

Food sample	Benedicts test	Biuret test	Ethanol (alcohol) test
J	Brick red	Blue	colourless
K	Brick red	Purple	Colourless
L	Blue	Blue	White emulsion

a) Give the letter of the food sample that contains:

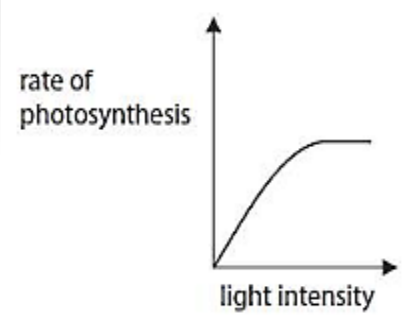
i) Fat

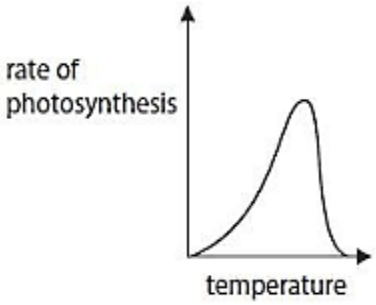
ii) Protein

iii) Reducing sugar

b) Describe an experiment that can be performed to test food samples for protein.

3.3 The figures below show the effect of light intensity and temperature on the rate of photosynthesis.





(a) Describe the effect of the following on the rate of photosynthesis.
(i) Light intensity
(ii) Temperature
(b) Explain the effect of the following on the rate of photosynthesis.
(i) Light intensity
(ii) Temperature
(c) How do other factors affect the rate of photosynthesis?

3.4 (a) Describe an experiment that can be performed to show the effect of light intensity on photosynthesis.

(b) How are leaves adapted for obtaining light needed in photosynthesis?

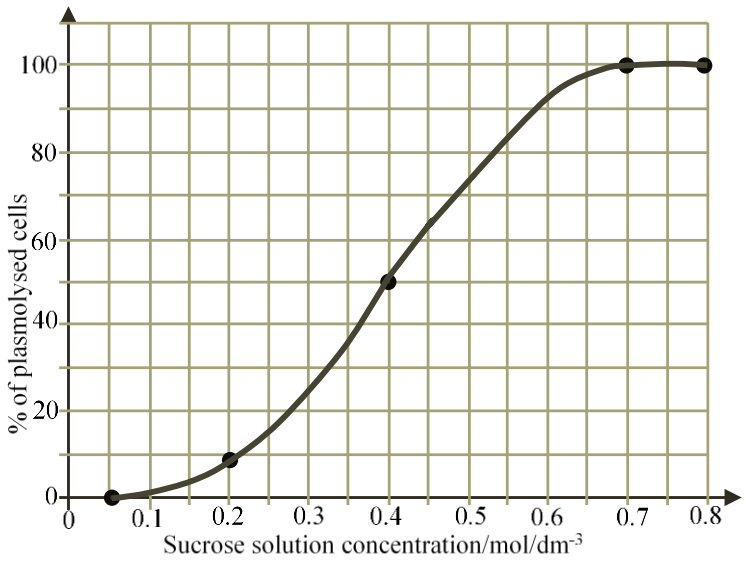
3.5 After a meal rich in carbohydrates, the concentration of glucose in the small intestine changes. The table below shows the concentration of glucose at different distances along the small intestine.

Distance along the small intestine in cm	Concentration glucose in mol dm−3
100	50
300	500
500	250
700	0

a) Use the data in the table to plot a bar chart on the graph below.
b) Describe how the concentration of glucose changes as distance increases along the small intestine.
c) Explain why the concentration of glucose in the small intestine changes
i) Between 100 cm and 300 cm.
ii) Between 300 cm and 700 cm.

CLASS: S.2 TOPIC 4: TRANSPORT

4.1 The graph below shows the percentage of onion epidermal cells plasmolysed in different concentrations of sucrose solutions.



(a) What physiological process is being investigated?
(b) Explain what happens to the cells from
(i) 0.1 mol/dm^{-3} to 0.7mol/dm^{-3}
(ii) 0.7 mol/dm^{-3} to 0.8 mol/dm^{-3}
(c) At what concentrations of sucrose solution was the percentage of plasmolysed cells
(i) 50%
(ii) 100%
(d) State the difference in appearance between the cells at 0.1 mol/dm^{-3} and 0.7 mol/dm^{-3} sucrose solution concentration.

4.2 (a) Describe the structure of the heart and its role in the circulatory system.

(b) (i) How does the heart's four-chambered structure facilitate its function?

(ii) What is the significance of the valves in maintaining blood flow?

4.3 (a)Explain the meaning of the following

(i) Passive immunity and

(ii) Active immunity.

(b) With examples, how are the above (a) types of immunity acquired?

(c)Describe how infections can weaken the immune system and impact overall health.

4.4 (a) An investigation was carried out on the uptake of potassium ions by root tissue. The root was cut into four discs of uniform size and each disc was added to an equal volume of a solution containing a fixed potassium ion concentration. The experiment was carried out in different oxygen concentrations and the results are shown in the table below.

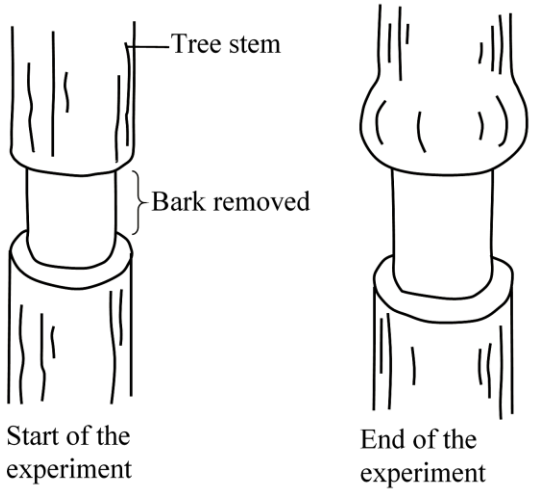
Oxygen concentration (a.u)	Rate of potassium ion uptake /a.u
0	7
4	27
11	92
20	100

(i) What is the main method by which potassium ions are taken into the root?

(ii) Using the information in the table, explain why the uptake of ions increased with increase in oxygen concentration.

(iii) State the rate of uptake you would expect if a drop of cyanide solution had been added to each of the four solutions. Explain your answer.

(b) Study the diagrams below and answer the questions that follow



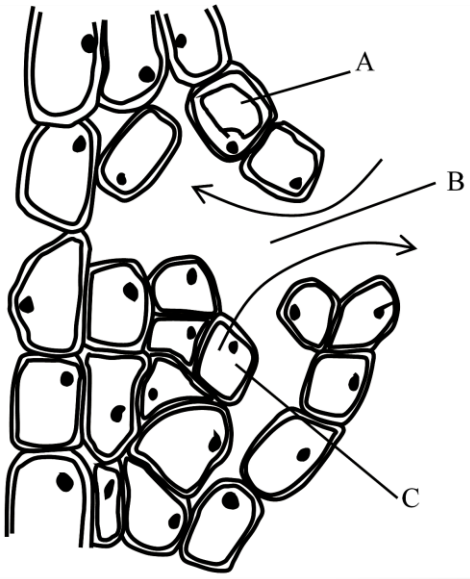
(i) What was the aim of the experiment?

(ii) Account for the results observed.

(iii) Does the setup shown in the experiment above affect the flow of water up the plant?

(iv) What would you expect to eventually happen to the tree that had a complete ring of the bark removed? Give reasons.

4.5 Below is a diagram of a plant structure.



(a) Identify the parts labeled A, B, and C.

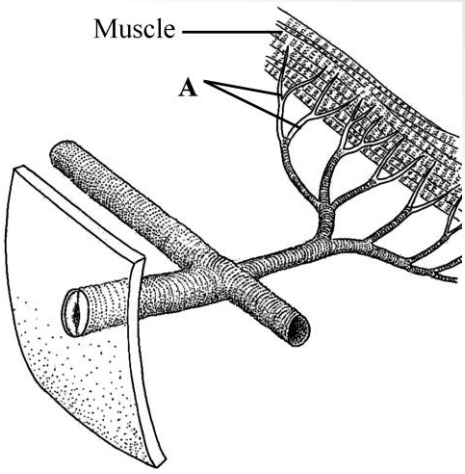
(b) State the function of part B.

(c) Name two other plant structures which play the same role as part B in plants.

(d) How do temperature changes affect the movement of substances along structure B?

CLASS: S.3 TOPIC 5: RESPIRATION & GASEOUS EXCHANGE

5.1 The following diagram shows a section of the respiratory system of a small animal.



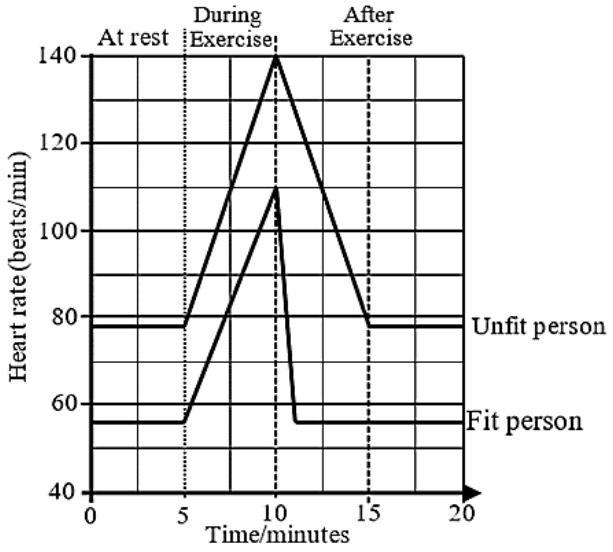
(a) Briefly describe the role played by abdominal muscles to allow air into the part labeled A.

(b) (i) Describe the adaptations of part A to perform its functions

(ii) How is the above structural arrangement different from the respiratory system in man?

(c) State any two reasons why plants lack such sophisticated respiratory systems.

5.2 The graph shows the heart rate of a fit person and an unfit person at rest, during exercise, and after exercise.



(a) Compare the heart rate of the fit person with the heart rate of the unfit person from 5 to 15 minutes.

(b) Cardiac output = stroke volume x heart rate

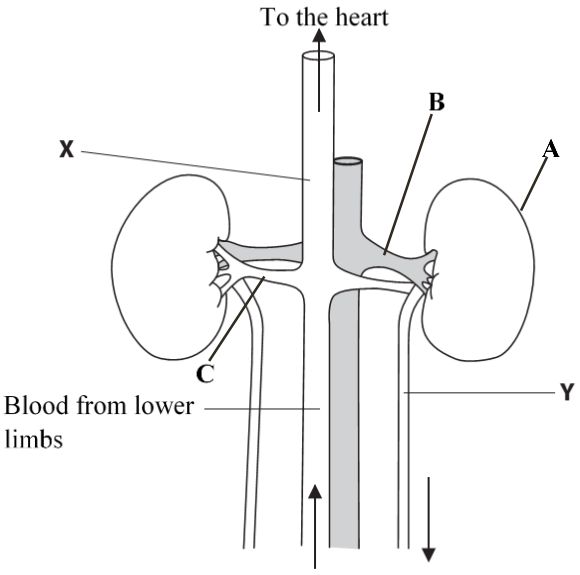
The stroke volume of the fit person at 10 minutes is $0.20dm^3$ per beat. Calculate the cardiac output of the fit person at 10 minutes using the graph.

(c) The recovery period is the time it takes for the heart rate to return to its rate at rest after exercise. Explain why the recovery period for the fit person was different from the recovery for the unfit person.

(d) Briefly explain the significance of increased heart beat rate during physical activity.

CLASS: S.3 TOPIC 6: HOMEOSTASIS-(TEMPERATURE REGULATION, OSMOREGULATION & EXCRETION)

6.1 The figure below shows the circulation of blood in the excretory system.



(a) (i) State any three functions of the organ labeled A

(ii) State any four differences in the blood composition in blood vessels B and C.

(b) (i) Name the part labeled Y.

(ii) To which structure does part Y transport the fluid?

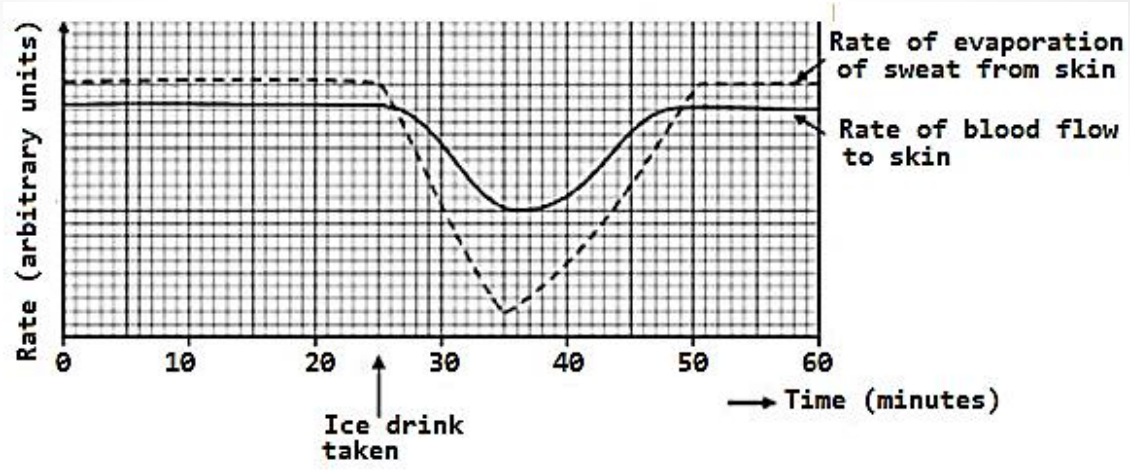
(c) (i) State two ways in which blood flow in vessel X is maintained.

(ii) Predict and explain what would happen to the volume of the fluid in Y if the pressure in blood vessel B is lower than normal.

6.2 (a) Describe the effects of ADH in the body.

(b) Compare nervous and hormonal communication.

6.3 On a hot day, a student drunk an iced drink. Graphs below show some of the changes to the student's body produced by the iced drink.



(a) Describe the changes in,

(i) Rate of blood flow to the skin after taking the ice drink;

(ii) Rate of evaporation of sweat from skin after taking the ice drink.

(b) Give explanations for the observed changes when the student took the ice drink.

(c) How are humans in cold areas adapted to temperature control?

(d) Suggest how a frog living in hot desert conditions might avoid overheating if external temperatures rose above 40°C.

6.4 Explain the following observations.

(a) A diabetic and non-diabetic person each ate the same amount of glucose. One hour later, the glucose concentration in the blood of the diabetic person was higher than that of the non-diabetic person.

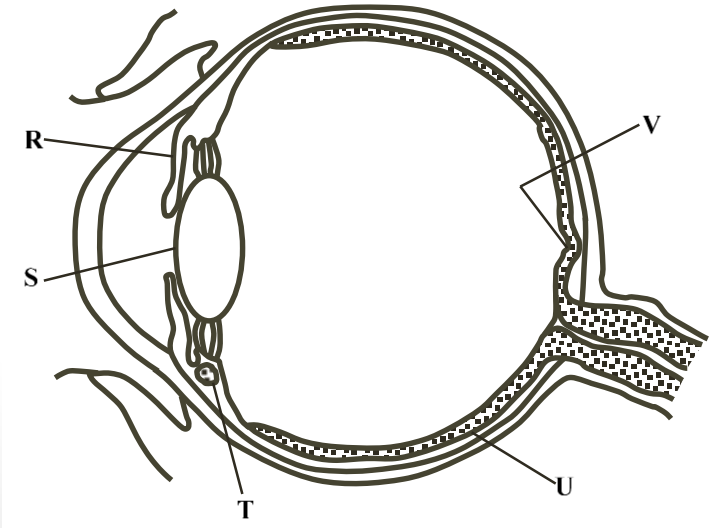
(b) The urine of a non-diabetic person does not contain glucose.

(c) In some forms of kidney disease, proteins from the blood plasma are found in the urine. Which part of the nephron would have been damaged by the disease? Explain your answer.

(d) If the glomerular filtrate of a diabetic person contains high concentration of glucose, he produces a larger volume of urine.

CLASS: S.3 TOPIC 7: COORDINATION IN PLANTS AND ANIMALS

7.1 The figure below is a longitudinal section through a mammalian eye. Study it and answer the questions that follow.



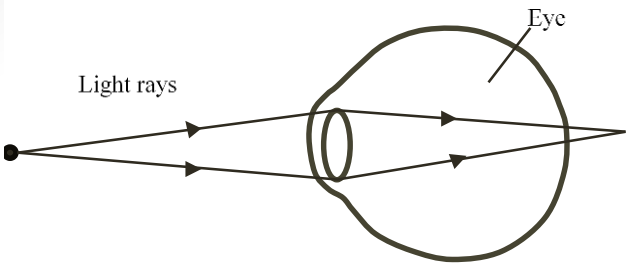
(a) Name the parts labelled S, T, U and V.

(b) State one function of structure T.

(c)(i) Briefly explain how structure R functions to control the amount of light reaching structure U in bright light.

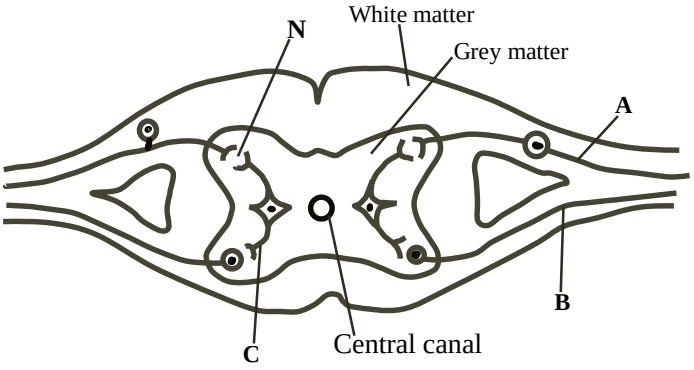
(ii) State the significance of structure V.

(d) The illustration below shows the path of light rays in a defective human eye.



(i) Name the defect.
(ii) What are the causes of the defect in (d) (i) above?
(iii) Explain how the defect can be corrected.

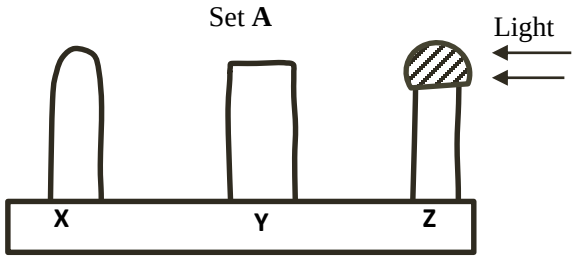
7.2 (a) What is a reflex arc?
(b) Study the diagram below and answer the questions that follow.

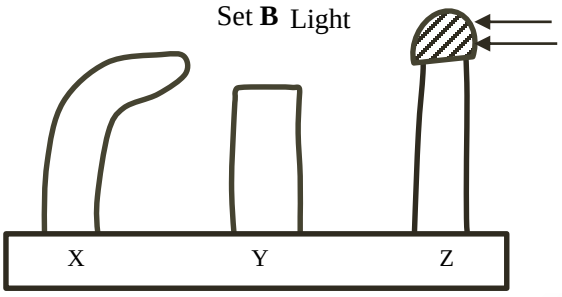


(i) Name the neurons labelled A, B and C.
(ii) State the structural differences between neurons A and B.
(c) The central canal is fluid filled.
(i) Name the fluid.
(ii) State two functions of the fluid.
(d) (i) Identify structure N.
(ii) Briefly explain how an impulse crosses structures N.
(iii) State two importance of structure N.

7.3 (a) Describe the sequence of events that cause a person may withdraw their hand from a hot object.
(b) Explain why response to stimuli is necessary in plants and animals.

7.4 Below are the diagrams of coleoptiles showing the effect of light on growth of wheat shoots?
Set B shows the results after four days. The three shoots used were treated as follows.
X- Was left intact
Y-Had its tip cut off
Z-Had its tip covered with an aluminium foil
(a) Name the type of response(s) being investigated.
(b) Explain the observations in
(i) X
(ii) Y
(iii) Z
(c) State any three commercial applications of auxins.





CLASS S.3 TOPIC 8: LOCOMOTION

8.1 The figure below shows one of the vertebral bones

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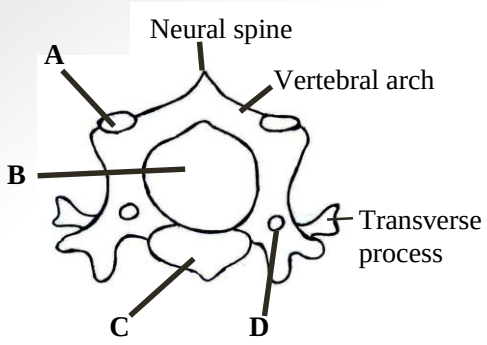


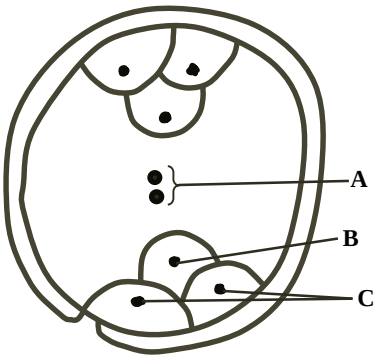
(a) (i) Name the parts labelled A, B, C, and D.
(ii) State the functions of the parts B, C, and D.
(b) (i) With reasons, state the region in the vertebral column where the bone was obtained.
(ii) How is the vertebra above adapted to perform its functions?

8.2 (a) Explain how hinge joints and ball-and-socket joints differ in terms of their range of motion and locations in the body.
(b) What is the role of ligaments in the human skeletal system, and how do they contribute to joint stability?

8.3 (a) Why do organisms move from one place to another?
(b) With examples, describe the main two types of joints.
(c) Describe the functions of exoskeleton arthropods.

CLASS S.4 TOPIC 9: GROWTH AND DEVELOPMENT

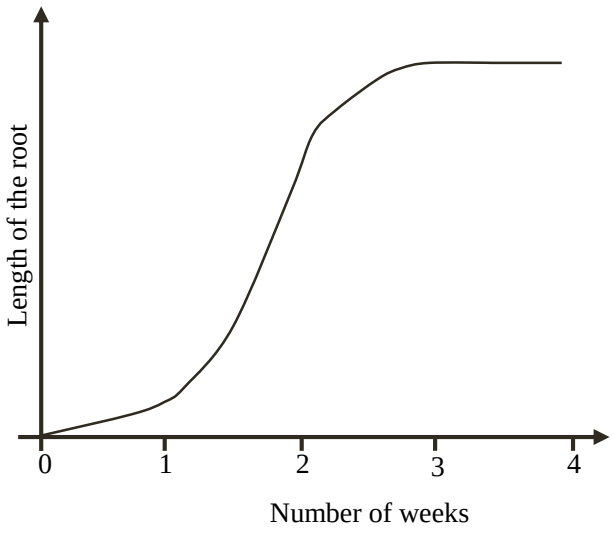
9.1 Study the following structure that develops within the ovule of a flowering plant



(a) Name the structure labelled A, B and C.

(b) (i) Describe the fate of structures A and B after fertilization.
(ii) What does the structure above develop into after fertilization?
(c) Name the process that leads to the formation of cell B.
(ii) If a plant cell from which the structure above is obtained has 16 chromosomes, state the number of chromosomes in A and B.

9.2 An experiment was carried out to find out the region of the root growth, freshly germinated beans with a root of about 2.5cm were used. The root was marked 2mm with lines in blank ink. It was then pinned on the underside of a cork, with the root hanging downwards, and the cork was put into the neck of a flask with little water in the bottom. The flask was then put in a dark place. After four weeks the root was examined and the rate of growth was calculated. The results were then plotted.

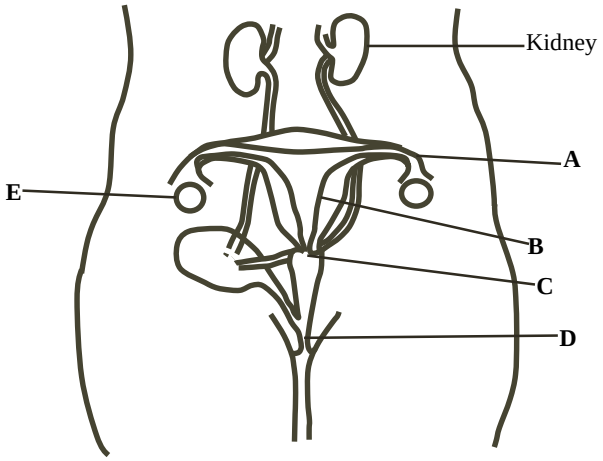


(a) (i) Explain the changes that took place during the experiment.
(ii) Why was water included in the flask?
(iii) Why was the flask placed in the dark?
(b) (i) In another experiment, the seeds failed to germinate. Under what conditions may a seed fail to germinate?

(ii) What should be done to make such seeds germinate?

CLASS S.4 TOPIC 10: REPRODUCTION

10.1 The figure below shows the front view of human female urinogenital system.

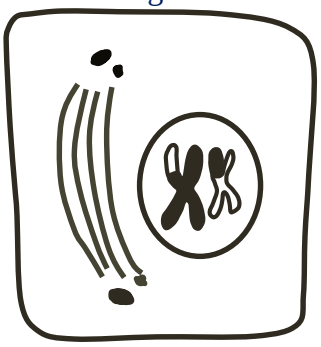


(a) Name the parts labelled A to E.
(b) State the functions of the parts labelled C and D.
(b) How are following parts adapted to perform their functions?
(i) A
(ii) B
(iii) D
(c) How are the hormones secreted by part labelled E, applied in the control of birth.

10.2 (a) Explain the process of fertilization in humans, including the events that occur from the release of the egg to the formation of a zygote.
(b) How does the timing of fertilization relate to the menstrual cycle?

CLASS S.4: TOPIC: 11 GENETICS AND EVOLUTION

11.1 The figure shows the structure of a cell in part of plant undergoing a type of cell division.



(a) (i) With a reason identify the part of the plant from which the cell was viewed from.
(ii) State the stage of cell division.
(b) (i) State the evolutionary advantage of the type of cell division shown in the figure.
(ii) Where in mammals does such of type of cell division occur?
(iii) State the importance of interphase during cell division.

11.2 During hybridization in animals, a white bull was crossed with a black cow, and the calves produced had both white and black patches.
(i) State the name given to the gene interaction above.
(ii) Using a genetic cross, what is the probability that the first offspring between one calf and a black cow will be black?
(iii) State any two advantages of cross-breeding in animal husbandry.
(iv)

TOPIC 12: ECOLOGY- ENERGY FLOW, INTER-RELATIONSHIP &HUMAN IMPACT

12.1 An experiment was carried out to find out changes in the population growth of yeast cells and paramecium when they were both growing in the same open bottle. 50g of glucose was put in the bottle, and the temperature was monitored at 25^{o}C.

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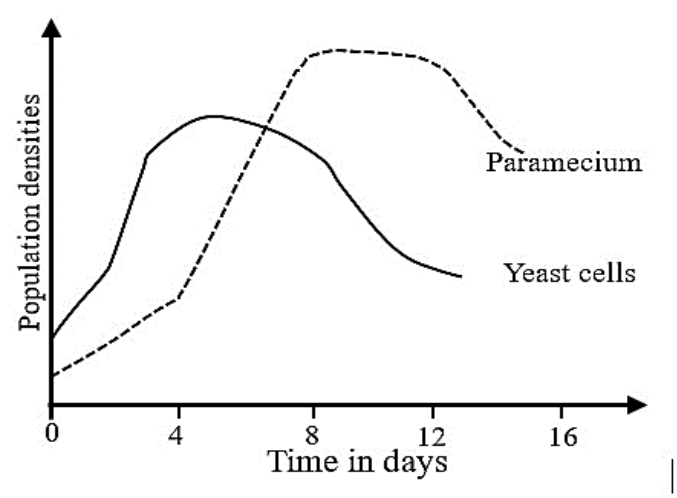


(a) Explain the changes in paramecium cells during the study.

(b)(i) State the differences in the rate of population in both organisms.

(ii) Explain the differences in the rate of population growth for both organisms.

(c)(i) What conclusion can be drawn from the above observation during the experiment?

(ii) Why are some organisms better competitors than other organisms?

12.2 (a) With two examples, explain the term parasitism.

(b) State that adaptations of parasites to survive.

(c) Give the reasons as to why the prevalence of HIV has increased in Uganda despite the numerous measures and sensitization.

12.3 The table shows the results of scientists who have been trying to estimate the number of different species there are on the Earth.

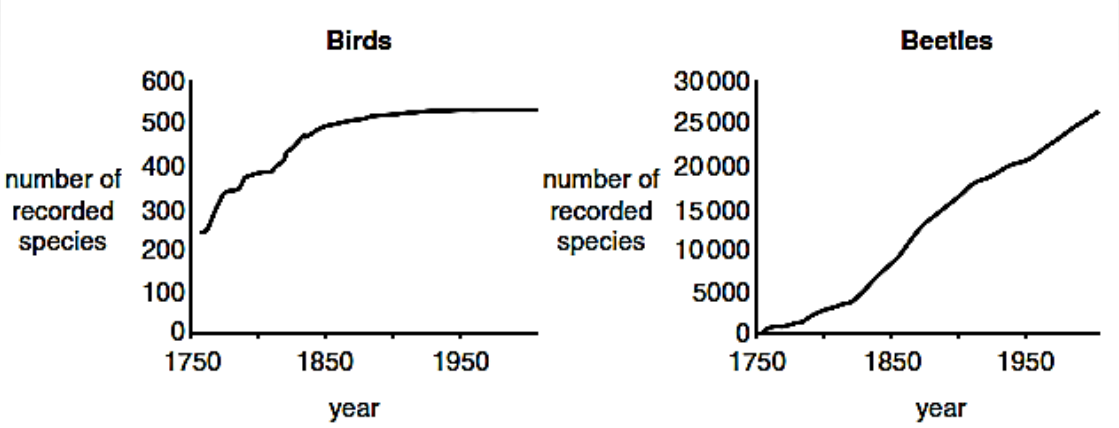
Kingdom	**Number of species already discovered and named**	**Number of species estimated to exist in thousands.**
Animals	953	7770
Plants	216	298
Fungi	43	611
Protoctists (mostly single celled)	21	64
Prokaryotes (no nucleus in cells)	11	10
Total	**1244**	**8753**

(a) Calculate this percentage of species in each kingdom that have already been discovered.

(b) Suggest reasons why more species of prokaryotes have been discovered and named than scientists have estimated to exist.

(c) Explain how plants are distinguished from organisms of other kingdoms.

The graphs show the number of species of birds and beetles recorded in Europe since 1750.



(d) (i) Describe the changes in the number of recorded bird and beetle species.

(ii) Suggest reasons for the changes in the number of recorded bird and beetle species.

DISCLAIMER.

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