Association of Biology Educators (ABE)

2023 EDITION 'O' LEVEL NATIONAL SEMINAR-SERIE No: 9 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

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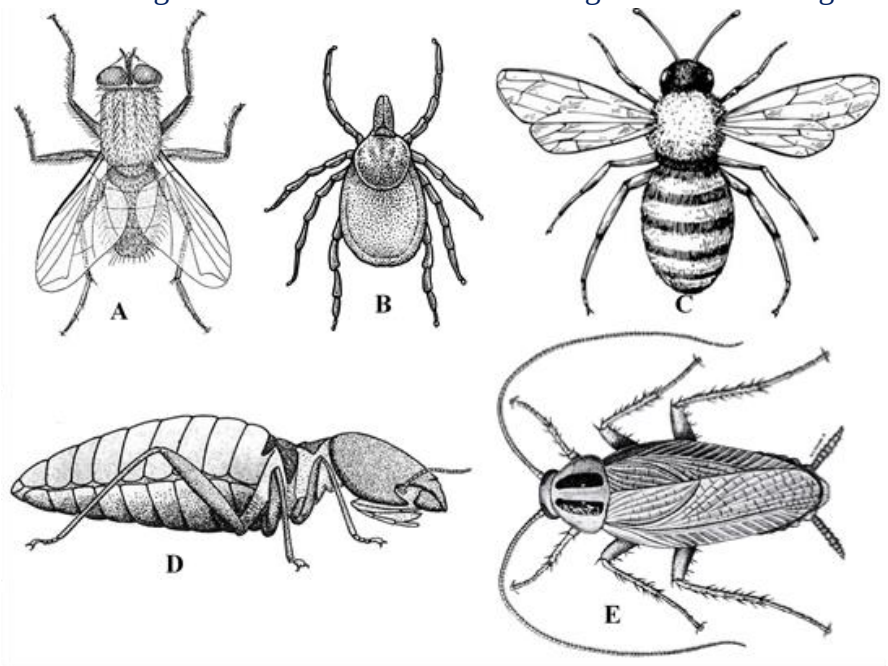
CLASS: S.1 TOPIC 1: DIVERSITY OF LIVING THINGS

1.1 Classification

1.1.1 (a) Describe the structure and function of animal and plant cells, stating their similarities and differences.

(b) Explain how these cellular features contribute to the overall organization and functioning of multicellular organisms.

1.1.2 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.

1.2 Flowering plant structures

1.2.1 Figure I below shows a vertical section through a flower of soybean, Glycine max, following self-pollination. **Figure II** shows part of the section at a higher magnification.

(a) Name parts labelled **A** to **C**.

(b) Briefly describe what happens to the structures shown in Figures I and II to bring about fertilization.

(c) Explain the advantages and disadvantages of self-pollination for flowering plants, such as soybean.

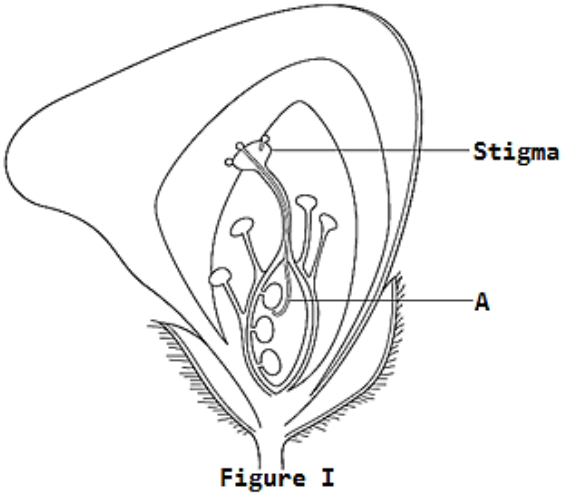


Figure I

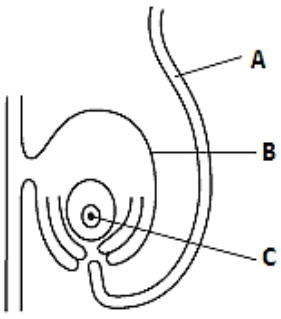


Figure II

1.3 Insect Features, Life Cycles and Economic Importance

1.3.1 The diagram below shows the life cycle of a butterfly.

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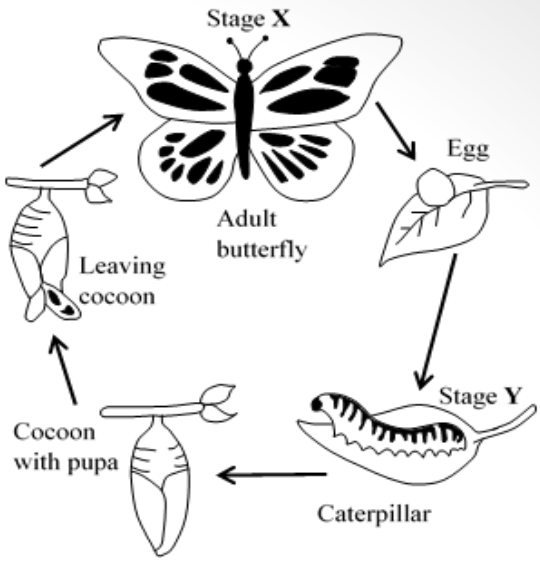
(a) (i) Name the type of life cycle shown above. Give a reason for your answer.
Complete metamorphosis: It has four main stages.
(ii) Suggest the importance of such a type of life cycle.
Each stage of the life cycle feeds on a different type of food. This reduces competition among the different stages increasing the chances of survival.
(d) Explain the economic importance of stages X and Y.
Stage X:
Stage Y:
(e) How is stage Y adapted for its survival?



CLASS: S.2 TOPIC 2: SOIL

2.1 Soil Fertility.

2.1.1 (a) Discuss the importance of air and water in the soil for animals living within it.
(b) (i) How do soil organisms contribute to soil fertility?
(ii) What role does soil conservation play in supporting these 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.

2.2 C, N, Water cycles

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2.2.1 The following information relates to the impact of human activities on the carbon cycle in recent years.

(a) Construct a bar chart to illustrate the data in table 1.

(b) Using information from:

(i) Tables 1 and 2, calculate how long fossil fuel reserves will last, if only 10% of fossil fuel reserves are available for human use.

(ii) Estimate the number of years it will take for atmospheric carbon to exceed 550 billion tons.

(c) Use the information in tables 1-3, and your own knowledge to describe in detail how carbon is cycled between living organisms, air and water. Your answer should include the names of any processes involved.

Table 1: World carbon reserves

Reservoir	Mass of carbon stored (billions of tons of carbon per year)
Oceans	35,000
Fossil fuels	10,000
Soil	1,500
Atmosphere	500
Plants	500

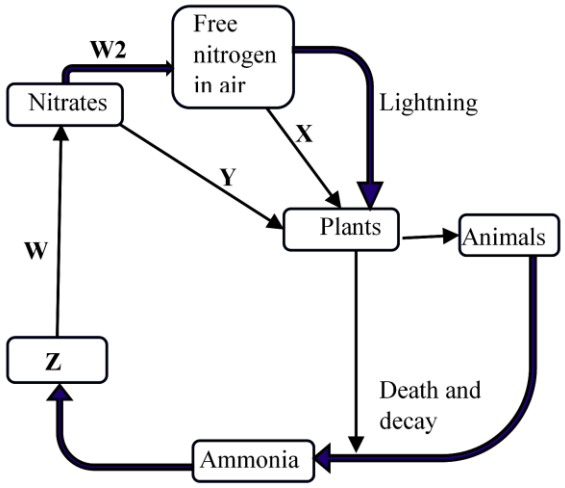
Table 2: Mass of carbon released by human activity

Activity	Mass of carbon released (billions of tons of carbon per year)
Burning of fossil fuels.	5.5
Deforestation	1.5

Table 3: Annual carbon gain by the atmosphere and oceans

Reservoir	Mass of carbon gained (billions of tons of carbon per year)
Atmospheric carbon	3.3
Oceanic carbon	2.0

2.2.2 The diagram below represents the



nitrogen cycle.

(a) Name the process labelled W, X, Y and W2.

(b) (i)Name the compound Z.

(c) (i) Name the group of organisms that carry out process W and X.

(ii) Name the part of the plant where process X take place.

(iii) What type of relationship is found between the group of organisms that carry out process X and the plant?

(d) How do human activities affect the cycle shown in the diagram above?

CLASS: S.2 TOPIC 3: NUTRITION

3.1 A student investigated the effect of enzyme concentration on the mass of product formed in one hour. The table shows the results of this investigation. The investigation used the enzyme pepsin from the stomach, at a temperature of 37°C and at a pH of 7.

Concentration enzyme (a.u)	Mass of product formed (g)
5	15
10	22
15	25
20	32
25	38
30	40
35	40
40	40

a) Plot a graph to represent the information in the table.

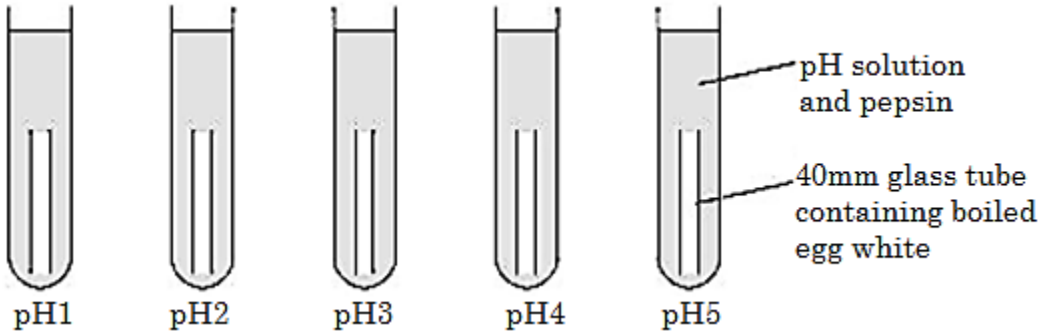
b) Describe the trend shown in the graph.

c) Explain the effect that enzyme concentration has on the mass of product formed.

d) Why was a temperature of 80°C not used in this investigation?

e) Suggest how the mass of product formed in this investigation would be increased.

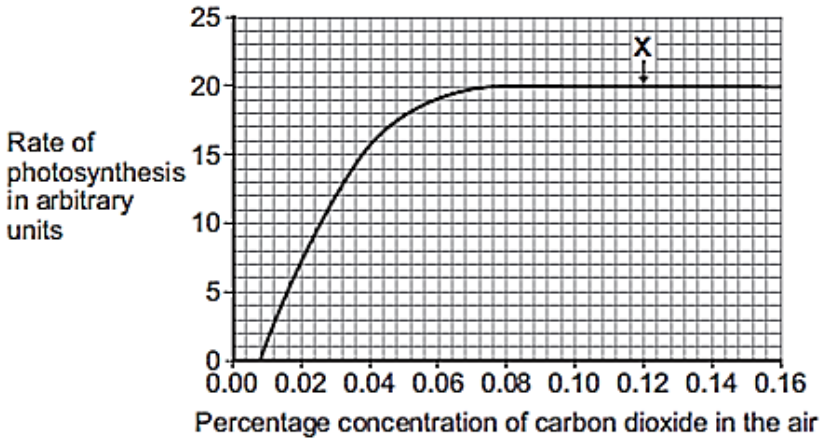
3.2 The Figure provided shows how a student set up equipment to investigate the effect of pH on the action of the enzyme pepsin on boiled egg white.



pH of the solution	Length of egg white in glass tube after 24 hrs./mm
1	36
2	10
3	24
4	28
5	40

The length of egg white in each of the tubes was measured after 24 hours. The results are shown in the table provided.
a) Plot a graph to represent the results in the table.
b) From your graph, explain the results.
c) (i) State the pH at which pepsin was most effective.
ii) How can the pH of a solution can be measured?
d) Describe how the method could be improved to obtain a more accurate measure of how much boiled egg white was digested by the pepsin.

3.3 Photosynthesis uses carbon dioxide to make glucose.
(a) Write an equation to illustrate the process of photosynthesis.
(b) State the following:
(i) The type of energy does a plant use in photosynthesis.
(ii) The part of a plant cell that absorbs the energy needed for photosynthesis.
The graph shows the effect of the concentration of carbon dioxide on the rate of photosynthesis in tomato plants at 20 °C.



c) (i) Describe the observed results shown in the graph.
(ii) What is the maximum rate of photosynthesis of the tomato plants shown in the graph?
(d) Suggest
(i) One factor that is limiting the rate of photosynthesis at point X.
(ii) Why farmers who grow tomatoes in greenhouses add excess carbon dioxide in green houses.
e) What other factors affect the rate of photosynthesis?

3.4 a) How is the structure of the leaf adapted for its role as the organ of photosynthesis?
b) Explain the factors that affect the rate of photosynthesis in land plants.

CLASS: S.2 TOPIC 4: TRANSPORT

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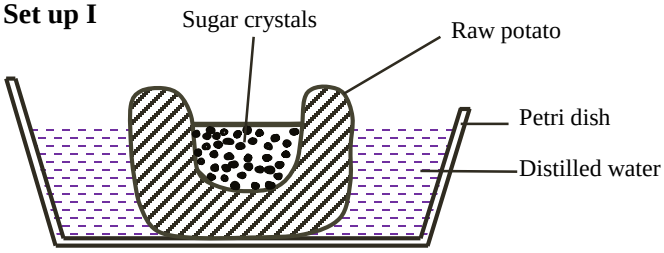
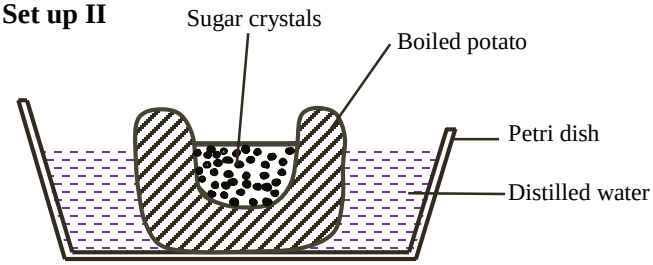
4.1 An experiment was carried out to demonstrate a physiological process in plants. The experiment was set up as shown below using potato materials, sugar crystals, and distilled water.

Set up I

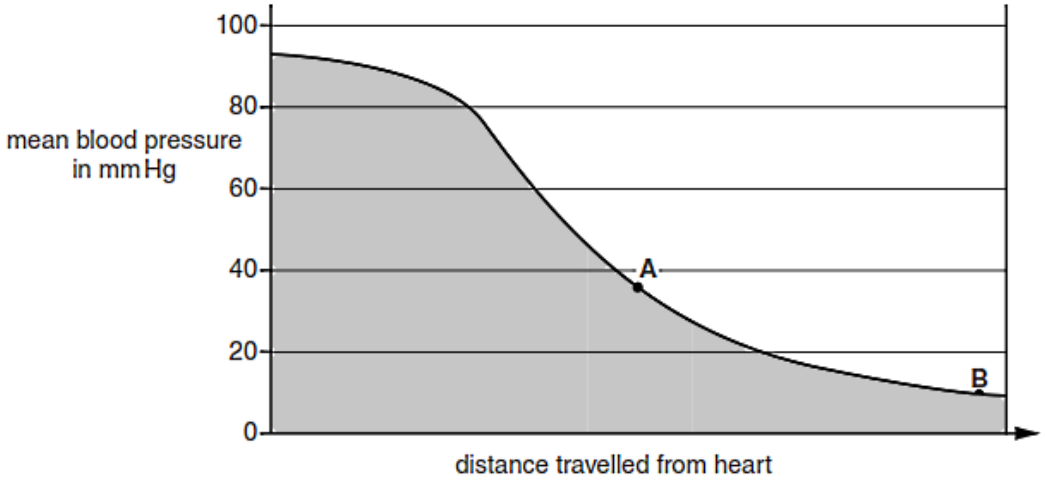


Set up II



(a)What process is being investigated?
(b) State what was observed after 4 hours in
(i) Set up I
(ii)Set up II
(c)Explain your observations in (b)
(d) Explain the following statements
(i) Active transport can only take place in living systems
(ii) Lowering the temperature from 38^0C to 25^0C lowers the rate of diffusion.
(iii) Active transport would stop if a cell is treated with a metabolic poison.
(a) Explain the mechanisms by which root hair cells absorb water and minerals from the soil.
(b) Discuss the role of key structures within the root hair cell in this process.

4.2 The figure below shows the changes in pressure as blood leaves the mammalian heart and passes through blood vessels.



a) Using information from the graph, identify the type of blood vessels at point A and point B.
b) Describe the changes in mean blood pressure with distance travelled from the heart.
c) Explain the changes in mean blood pressure with distance travelled from the heart.
d) How is the mammalian heart structure suited for functioning?

4.3 a) Describe an experiment that can be performed to investigate how air movement affects the rate of transpiration.

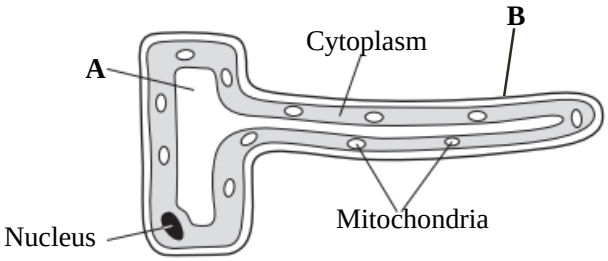
b) Explain how pesticides dissolved in soil water can be absorbed by plant roots and transported to the leaves to kill insects feeding there.

4.4 A student investigated the movement of water using hens' eggs placed in vinegar for two days to dissolve the shell. The eggs were then weighed and placed in different solutions. After 24 hours the eggs were weighed again. The figure below shows the results.

Solution	Mass of the egg at the start in grams	Mass of the egg after 24 hours in grams
Tap water	77	84
5% salt	77	77
10% salt	77	72

a) Calculate the per cent change in mass of the egg in each solution.
b) Explain the observed changes in per cent mass of the eggs in each solution.
c) Assuming that plant cells contain the same solute concentration like eggs, explain what would happen to plant cells when they are placed in each of the solutions.

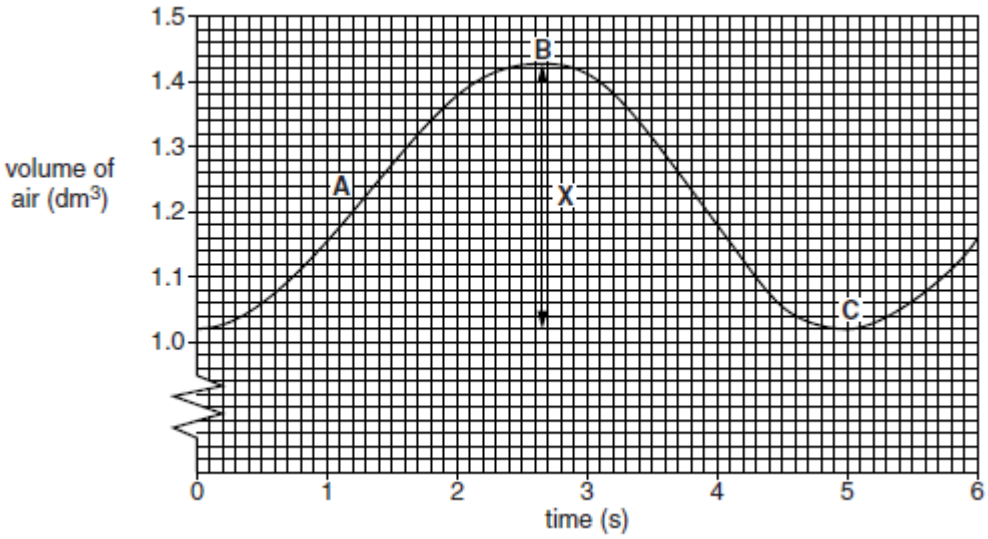
4.5 The diagram below shows a structure used for transport in plants. Carefully examine the structure and answer the questions that follow.



(a) (i) Identify the structure above.
(ii) Give the name of the part labeled A and B.
(iii) Name two materials that enter the part labeled A.
(b) (i) How is the structure above adapted to perform its function?
(ii) Briefly describe how the structure carries out its functions.

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

5.1 The figure below shows changes in volume of air in the lungs of a student at rest during one breath.



(a) Describe the changes in volume if air in the lungs in the first five minutes.
(b) Explain what causes the change in the volume of air between points B and C
(c) How is the alveoli adapted for gaseous exchange in man?

5.2 The graph shows the rate of oxygen intake before, during and after vigorous exercise of an athlete.

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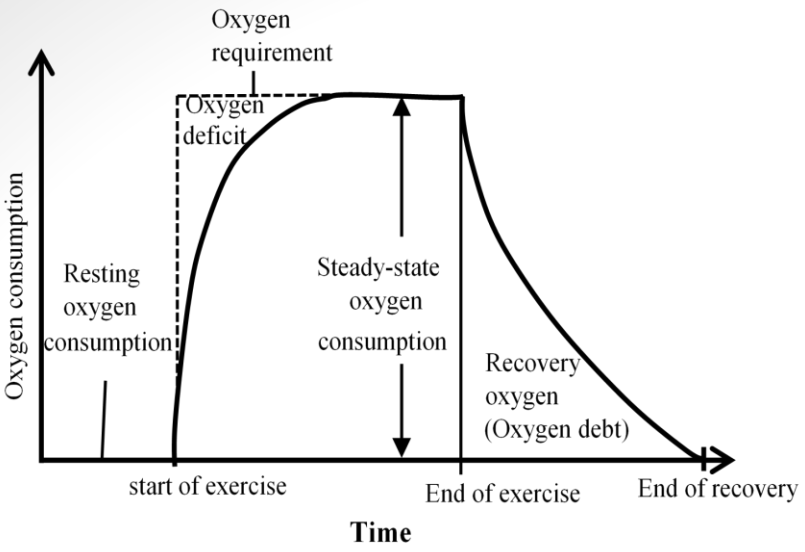


(a) Based on the graph, compare the oxygen consumption before and during vigorous exercise.

(b) Explain the importance of increased pulse rate during vigorous activity and why it takes several minutes for the pulse rate to return to normal after activity.

(c) Living organisms require energy for various activities taking place in their bodies. State two ways in which energy is used by animals.

(d) Why would you give an athlete glucose and not sucrose after a race?

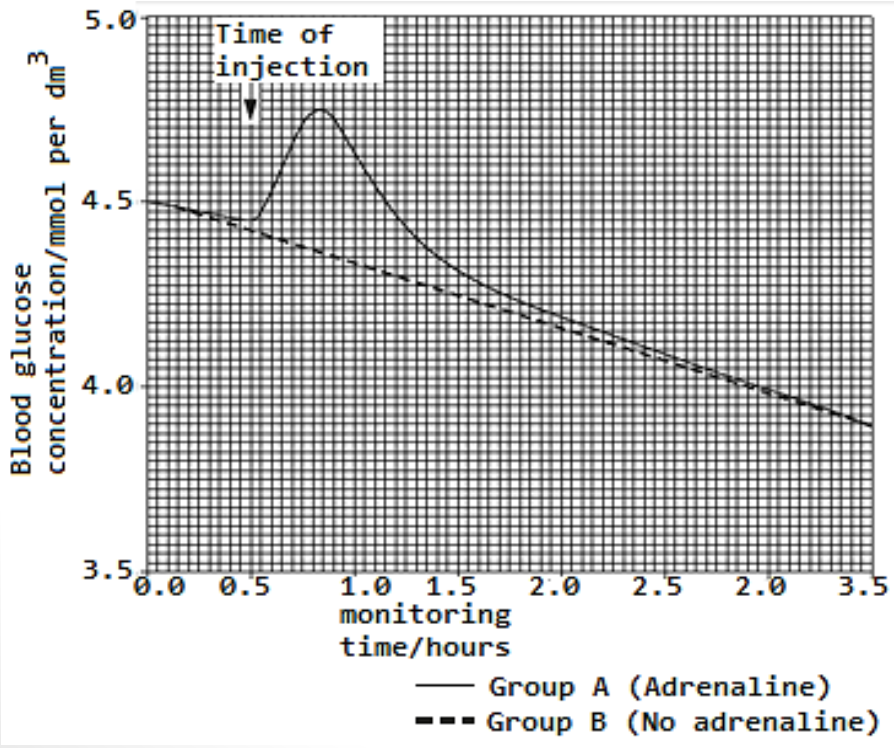
(e) A man who normally lives at sea level moves to a place which is 2000 meters above sea level. He finds that his breathing rate is increased. Explain why this happens.

(f) Give five characteristics of an efficient respiratory organ of an animal.

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

6.1 A scientist investigated the effect of adrenaline on blood glucose concentration on two groups of rats.

Group **A** was given an injection of adrenaline. Group **B** was given an injection that **did** not contain adrenaline. The blood glucose concentrations of the rats in both groups were monitored for three hours after the injections. The rats did not eat for 12 hours before and during the investigation. Results are shown in the figure below.



(a) Describe the blood effect of adrenaline on blood glucose concentration for group A rats.

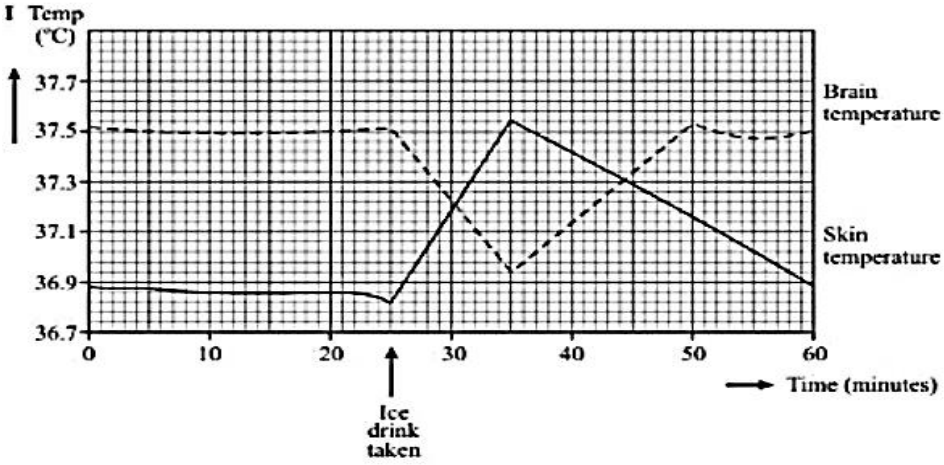
(b) Explain the results shown in the graph for group A.

(c) Suggest why group B was given an injection that did not contain adrenaline.

(d) Another group of rats **(Group C)** was given an injection that did not contain adrenaline. The rats were given food after 2 hours of monitoring. Predict the changes to blood glucose concentration in this group of rats and sketch a line to show your prediction on the graph in the figure above.

(e) Explain two other effects of adrenaline on the body, other than a change in blood glucose concentration.

6.2 The figure below shows the changes in the student's body on a hot day after taking an iced drink.



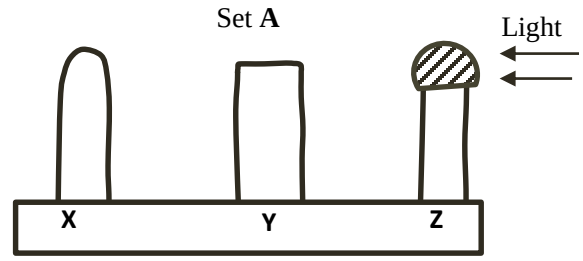
(a) State the difference in the changes in brain and skin temperature after an iced drink is taken.

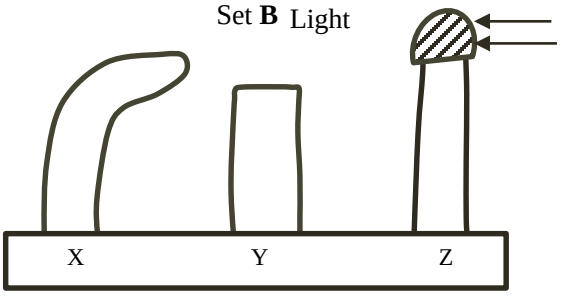
(b) Give reasons for the above difference (s).

(c) Describe the roles of different parts of the skin in temperature regulation.

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

7.1 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

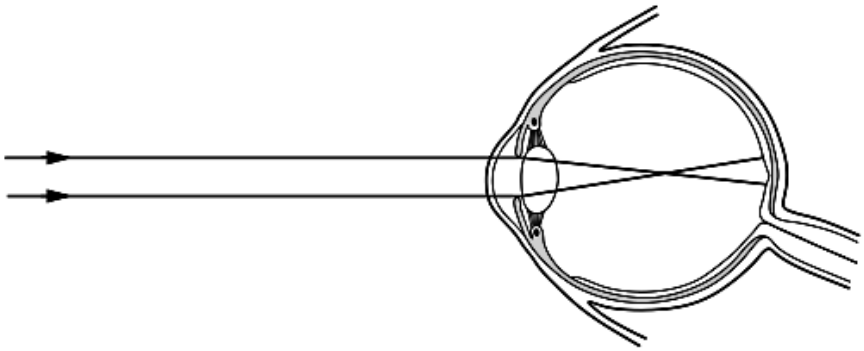
(i) X

(ii) Y

(iii) Z

(c) State any three commercial applications of auxins.

7.2 The diagram shows an eye with a defect, for a person looking at a distant object.



a) (i) What is meant by eye defect?

(ii) Describe the type of eye defect shown in the figure.

b) Explain

i) With an illustration, how the type of eye defect shown in the figure can be corrected.

ii) Why older people cannot focus clearly on near objects.

iii) How the size of the pupil of the eye changes when a torch is shone into the eye of a person.

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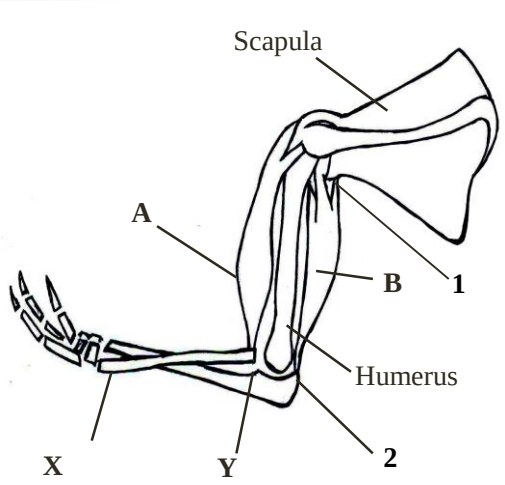
CLASS S.3 TOPIC 8: LOCOMOTION

8.1 The figure below shows the movement of the forelimb.



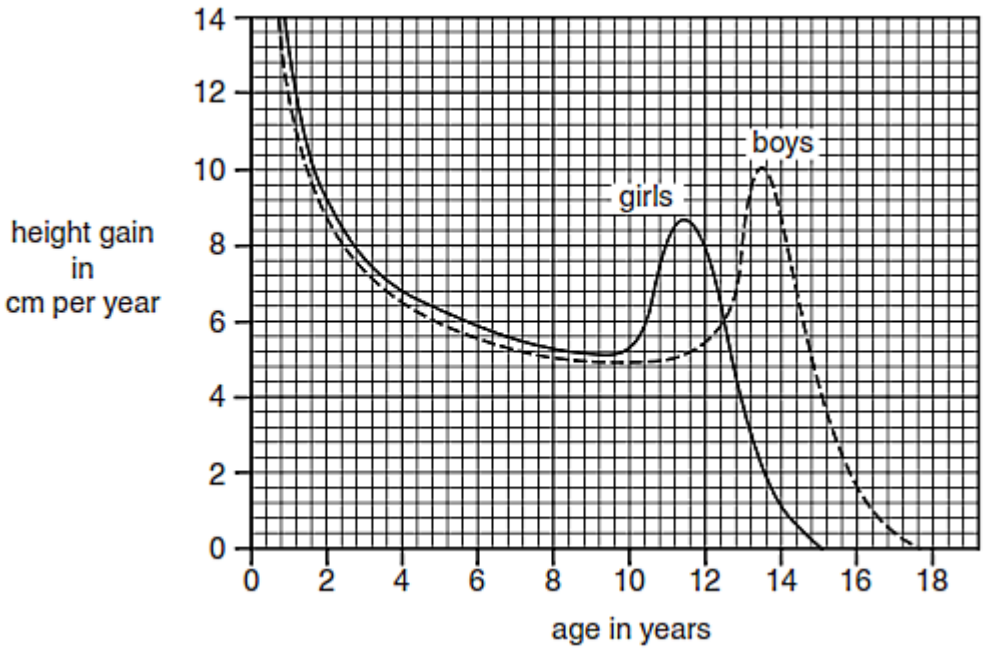
(a) (i) Name the bones labeled X and Y.
(ii) Name the types of synovial joints 1 and 2.
(b) What are antagonistic muscles?
(c) Briefly describe the antagonistic nature of muscles A and B, to cause movement of different parts of the body.
(d) Why does the active working of muscles A and B cause sweating in organisms?

(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?

8.2 (a) How do tendons differ from ligaments, and what is their function in relation to muscles and bones?
(b) Discuss the concept of muscle antagonism and how it contributes to joint movement and stability.
(c) Provide an example of an antagonistic muscle pair and explain how they work together during a simple movement, such as bending the elbow.

CLASS S.4 TOPIC 9: GROWTH AND DEVELOPMENT

9.1 The graph shows the growth rate given as average height gained per year by girls and boys at different ages.



a) Describe the growth pattern in girls and boys for the period shown.
b) Compare the growth pattern in girls and boys for the period shown.
c) Using the graph, state the age at which
(i) Girls start adolescence.
(ii) Boys grow at their fastest rate.
(iii) There is the greatest difference in the rate of growth between girls and boys.
d) What type of cell division enables boys and girls to change in height?

9.2 (a) Explain the different conditions necessary for germination.

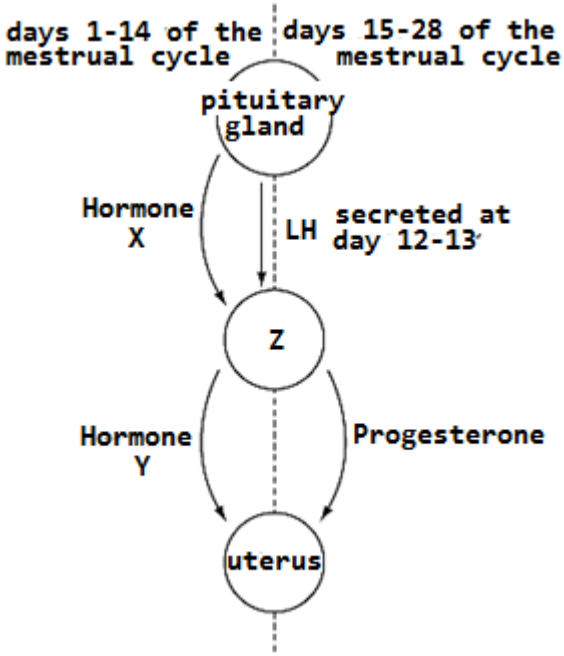
(b) Describe an experiment to demonstrate that oxygen is used during respiration of germinating seeds.

CLASS S.4 TOPIC 10: REPRODUCTION

10.1 (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?

(c) Why is the understanding of this process important for individuals seeking to plan or prevent pregnancy?



10.2 The human menstrual cycle is controlled by four hormones. Figure below is a diagram that shows the site of production and the target organs of these hormones.

(a) (i) Name hormones **X** and **Y**.

(ii) Name organ **Z**.

(b) Describe the role of progesterone during the menstrual cycle and during pregnancy.

(c) Describe the role of hormone X in the menstrual cycle.

(d) Other than those in the diagram, state the role of any other two hormones secreted by the pituitary gland**.**

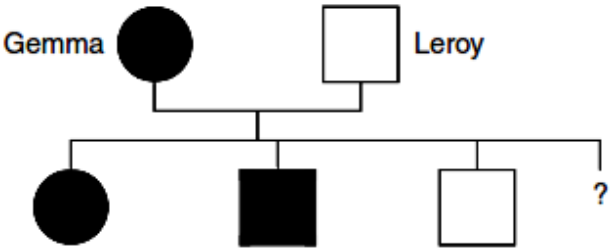
CLASS S.4; TOPIC: 11 GENETICS AND EVOLUTION

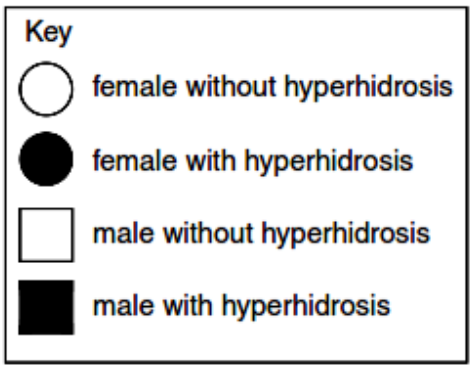
11.1 (a) Explain how sweating can cool the body temperature.

(b) Too much sweating (hyperhidrosis) is caused by a dominant allele.

(i) What is meant by dominant allele?

Study the family tree provided.





(ii) What is the probability that the child produced by Gemma and Leroy will have hyperhidrosis? Show your working.

(c) If Gemma is injected with a drug containing an antigen made by bacteria, so as to make her sweat less, explain how her body destroys antigens.

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

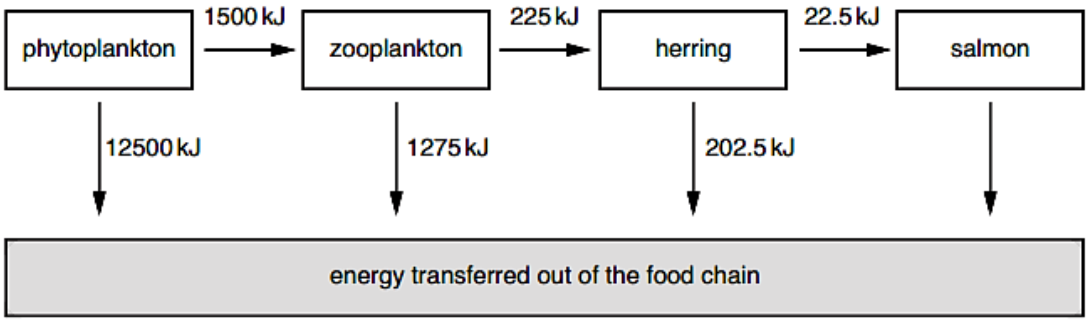
12.1 (a) To study the population growth of organisms in an ecosystem, numerous methods are used to estimate populations. Describe how the following methods can be used to estimate the population of organisms.

(i) Capture-mark recapture method

(ii) Quadrat method.

(b) A pond is regarded as an ecosystem. Explain what is meant by an ecosystem and how organisms in the pond form an ecosystem.

12.2 The figure below shows the energy flow in part of one food chain from the food web.



(a) State the feeding (trophic) levels to which each organism belongs.

(b) Calculate the energy efficiency (% of energy of one organism going into the next organism) as follows, in this chain:

(i) Between zooplankton and herring.

(ii) Between herring and salmon.

(c) Use your answer to part (b) to explain why it is unlikely that there would be another trophic level after the salmon.

(d) Explain the reasons why some energy from each trophic level is lost out of the food chain.

12.3 (a) What reasons are responsible for the widespread deforestation in Uganda?

(b) Explain the effects that large-scale burning of forests may have on the Earth's atmosphere in the short and in the long term.

(c) Explain the effects of adding large amounts of methane to the atmosphere.

12.4 The figure below shows a food web

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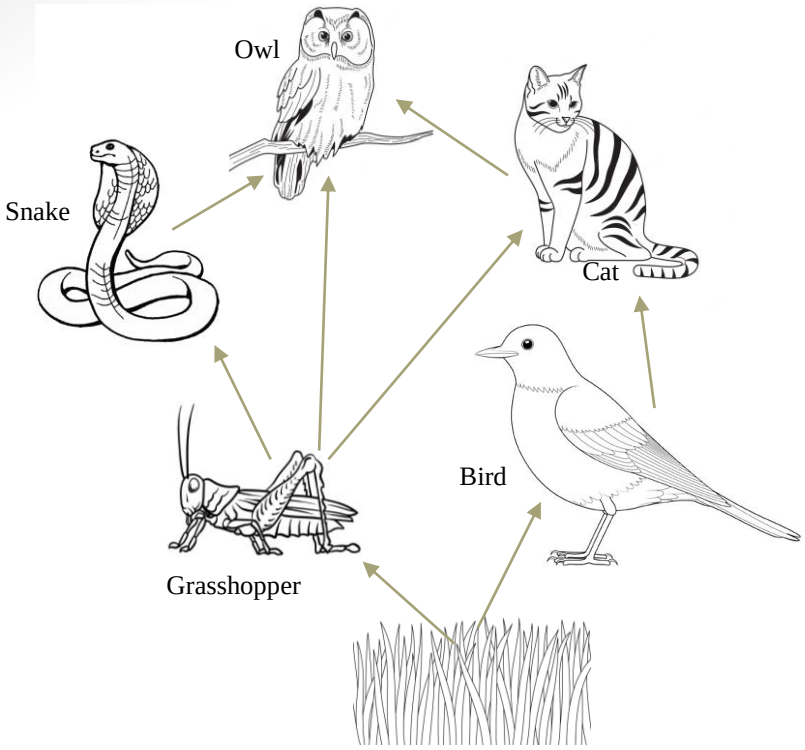

(a) (i) Name the secondary consumers.
(ii) Explain the effect of removing the bird and grasshopper on the interaction above.

(b) (i) What would happen to energy from the grass to the owl?
(ii) Explain your answer in b(i)

(c) (i) Predict and compare the numbers of owls and birds in an ecosystem.
(ii) Give a reason for your prediction in c(i)

(d) Describe the role of fungi and bacteria in the above interaction.

DISCLAIMER.

These questions are built in a similar style to that presented within the previous exam board's sample assessment materials. There can be no guarantee of the extent to which these questions will reflect the actual examination questions students will sit. We hope that schools and students find these questions useful in the exam preparations for this year. However, we take no responsibility for the relevance of this document to actual examinations sat.

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