SENK "O" LEVEL BIOLOGY SEMINAR

@

ST. ELIZABETH NKOOWE S.S

ST. ELIZABETH SEN. SECONDARY SCHOOL NKOOWE
EDUCATION IS LIGHT

22nd SEPT. 2024

SEMINAR BOOKLET

With:

- 50 Paper Items
- Expected Responses
- 10 Paper 2 Items
- Expected Responses

Authors

DA SUMMIT MIRRORS

MEGA "O" LEVEL INTERACTIVE BIOLOGY SEMINAR

AT *ST.ELIZABETH NKOOWE SENIOR SECONDARY SCHOOL*

Together with *"DA SUMMIT MIRRORS"AND "HES MOCK BODY"*

Preface

The seminar was organized to equip learners with the new and final technics/skills of attempting items from both paper one and paper 2 by organized, well trained and trusted UNEB facilitators. The booklet has 50 paper 1 items and 10 items for practicals from different E.O.C, all developed and coordinated based on the current demands of new curriculum and we surely believe that after the seminar and practice of the different items and further research of the items, our pioneers (candidates) will excel in the exams.

Acknowledgment

- First and foremost, we thank the Almighty Lord for guiding us through the preparations.
- We also extent our sincere thanks to our main facilitator [redacted] for his guidance, coordination of items and the time spent with us to ensure excellence of our learners in this biology seminar. We also thank MR. NSUBUGA SWAIBU and MR.KATEGAYA ERIA for your kind guidance and support
- We also extend our great thanks to the mighty school SENK for the support and guidance upon the possibility of the seminar. We greatly thank MR. KYEYUNE FRANK (H/M) and Mr. HABIMAANA ALEXANDER (DOS) for their tremendous support and guidance.
- We also thank school administrators for different schools for the attendance and wishing well their learners for excellence and those that did not manage due to fixed programs, we still keep the love.
- And whoever has done something for the success of this occasion, we are so humbled and grateful

Dedication

This seminar is dedicated to all our beloved candidates of the year 2024 the pioneers of new curriculum. Thanks for the perseverance and let's keep hopes high, revise harder and as u always ask for God's intervention. We love you all and wish you success in your exams.

Authors

- ✓ **MR. MUGWANYA STEVEN MAJE (0701776545/0785945419)**
- ✓ **MR. SAKA DERRICK DARWINS (0775201736/0702102308)**
- ✓ **MR. LUBEGA SHARIF (HOD) (0704326171)**
- ✓ **MR.WALAKILA CLOVIS (0786366147)**
- ✓ **MR.KAWERU COLLIN (0706130050)**

SEMINAR ITEMS AND EXPECTED RESPONSES

Biology paper 1 consists of 7 examination items, 3 compulsory items in section A and 4 in section B, which is divided into two subsections each with two items but a learner should attempt only one item from each subsection.

SECTION A

SEMINAR ITEMS FOR ITEM 1

ITEM 1.1

Mr. Katongole bought an acre of land mainly consisting of sand soil in Kyotera village. He planted quality maize seeds in a well-spaced pattern and later applied artificial fertilizers however the maize plants had stunted growth, deformed roots and yellow leaves. After 2 months, his maize plants were also attacked by an invasive pest called ***fall army worm*** and hence the yields were very low after incurring in much money.

Figure 1 shows fall army worms on maize leaves and its destruction.

Task

(a) Describe how the fall army worm could have resulted into low crop yields.

(b) Explain to Mr. Katongole why his crops had stunted growth, deformed roots and yellow leaves even when he applied good farming practices.

(c) Suggest possible solutions to him on how to overcome the above challenges in the next seasons.

ST.CHARLES LWANGA INTERNATIONAL SCHOOL

ITEM 1.2

Mr. Majje is a great farmer in Nakaseke district. Last season he practiced strip cropping by planting ground nuts, Irish potatoes, sorghum, sugarcanes and banana plants in corresponding rows. During the flowering stage of ground nuts, a severe hailstorm hit his crops in one night, destroying all his crops and got worried of food insecurity in his family. However to his surprise, three weeks after the incidence, Irish potatoes, sugarcanes and banana plants were seen re-growing but not ground nuts and sorghum. .

Task.

(a) Identify the plant organs that were affected by the hailstorm.

(b) Explain how the hailstorm affected the normal functioning of his crops?

(c) Describe why some plants where able to re-grow but others failed after three weeks from the incidence.

HIGHFIELD HIGH SCHOOL OF EAST AFRICA.

ITEM 1.3.

Cassava farmers in Luwero district made serious loses in 2023. They observed rare appearances on their cassava plants, where most plants developed yellow leaves with mosaic patterns, had stunted growth and deformed tubers and none of them knew the cause of the rare appearances on their cassava plants.

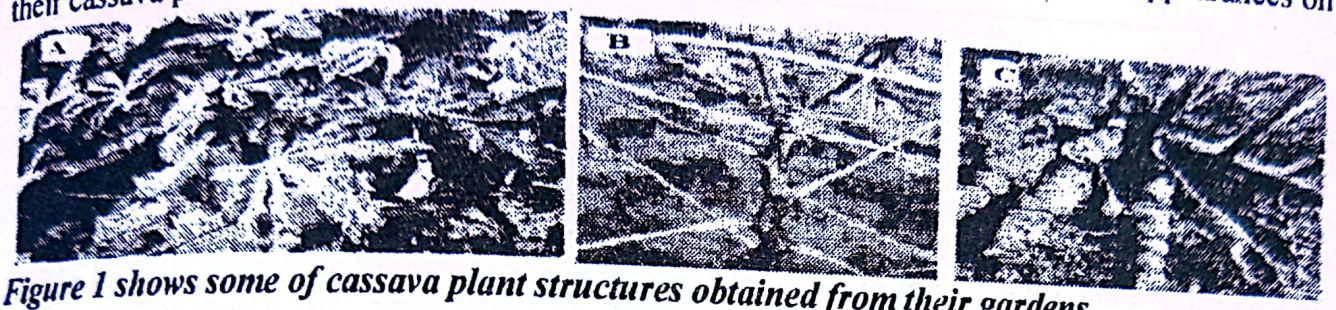


Figure 1 shows some of cassava plant structures obtained from their gardens.

Task

(a) Identify the plant structures that were affected by rare appearances.
(b) Explain how the appearances of their cassava plants could have resulted into serious loses.
(c) Describe the cause and spread of the rare appearances on their cassava plants and advise the farmers on how to overcome the above problems in future.

KASULE HIGH SCHOOL

ITEM 1.4.

Mr. Tumusiime transplanted his tomato seedlings in morning and did not water them. By 4:00pm of the same day, most seedlings had wilted and others had almost dried. He irrigated the wilted seedlings in evening and by morning they had their leaves well spread and stems erect and hard. He did not mulch his plants and after one month without rainfall, his tomato plants had yellow leaves, were stunted in growth and when he uprooted one, it had deformed roots. He decided to irrigate these crops though the water was salty and by three days, the tomato plants had wilted and dried.

Task

(a) State the processes that could have caused the wilting of the plants after transplanting and why the seedlings wilted but when irrigated the leaves spread and stems where hard and erect.
(b) Explain the causes of the different challenges faced by the tomato plants due to the actions of Mr. Tumusiime.
(c) Suggest the possible solutions to how Mr. Tumusiime can avoid the challenges in the future.

MOUNT OF OLIVES COLLEGE KAKIRI

ITEM 1.5.

Mr. Joseph is a qualified herbalist in Wakiso district. He obtains herbal medicine from different plant structures either by plucking off leaves, digging out roots, removing of barks of trees or uprooting out the plants. The number of medicinal plants has reduced due to his poor harvesting methods and his medicine is expensive on the market.

Task

(a) Identify the plant processes affected by his poor harvesting methods.
(b) Explain how the actions of Mr. Joseph affect the normal functioning of medicinal plants?
(c) How are the medicinal plants able to survive despite the poor harvesting methods of Mr. Joseph.

ST.JOHN'S SENIOR SECONDARY SCHOOL WAKISO.

ITEM 1.6

In Nkoowe village, the L.C.1 chairperson provided two categories of cassava plants to his farmers to select the one that bears larger tubers. The average results obtained after the first season of 9 months are summarized in table below.

Batch number	1st	2nd
Size of leaves	Large	Small
length of leaves (cm)	22	9
Length of plant (cm)	210	100

Task

(a) From the average results in the table, explain the batch number that:

(i) Developed larger tubers when the two were grown in same environmental conditions.

(ii) Can survive in drought conditions

(b) Suggest ways how farmers can obtain high yields from the cassava plants from both batches during drought conditions.

NKOOWE HIGH SECONDARY SCHOOL

ITEM 1.7.

Mr. Mukisa and Mr. Magala are two commercial farmers for beans in kalege village. Mr. Mukisa always plants flowers near his garden but Mr.Magala does not. During flowering stage of the beans, more bees are observed in Mr.Mukisa's garden and he has been always obtaining high yields than Mr.Magala who does not the reason behind his colleague's trick.

Task

(a) Describe the processes that occur from the time bees visited Mr.Mukisa's garden till formation of bean pods.

(b) Explain why Mr. Mukisa obtains high yields than Mr. Magala.

(c) Advise how both farmers can ensure more yields in the coming seasons?

ITEM 1.8.

Joseph is a great maize farmer in Masaka district. He bought land which starts from an extremely dusty and busy murram to swampy area. He planted quality maize seeds in a recommended spacing however he received very low yields from maize plants near the road compared to those towards the swamp.

Task:

(a) Identify the processes affected in the maize near the road.

(b) Explain the possible causes of the difference in the yields obtained by the plants in the different areas.

(c) How did Joseph's maize near the road manage to give some yields?

PEARL HIGH SCHOOL NANSANA

ITEM 1.9.

Through the theme of "PROSPERITY FOR ALL", the NRM government encourages local people to engage in farming. It has decided to provide different planting materials for cassava, banana, onions and ginger to the farmers however there is a need to train the farmers on how handle, and manage them before being provided.

Task

(a) Suggest the possible planting materials to be supplied by government for the above plants.

(b) Explain how the different planting materials are able to give rise to new plants.

(c) Describe other planting materials that the government can provide to farmers in your locality and suggest how they give rise to new plants.

ITEM 1.10.

Kyotera village received heavy rains which caused heavy floods around the area and most gardens remained water-logged for a long period of time. Farmers observed the leaves of their yellowing, some with purple leaves, others falling off prematurely, crops stunted in growth and others had started drying and dying.

Task:

(a) Identify the plant nutrients that are responsible for the observed plant challenges.
(b) Explain how the weather patterns experienced in village could have led into the challenges.
(c) Advise the farmers on how to prevent the challenges in the near future.

ITEM 1.11.

Mr. Lauben planted beans in his garden having mature sugarcanes. Just before the beans could flower, heavy storms hit the garden, destroying all his crops. After a month, Lauben was surprised to see new young sugarcanes growing, but there were no new beans.

Task:

(a) Identify the plant structures affected by the heavy storms?
(b) Explain how the heavy storm affected the normal functioning of the crops.
(c) Explain to Mr. Lauben why young sugarcane plants were able to grow despite the heavy storm while the beans didn't grow.

EEXPECTED RESPONSES FOR ITEMS OF ITEM ONE

ITEM 1.1

(a) Fall army worm fed on leaves; affecting different processes in the plant and these include;

✓ Feeding on leaves *reduced the rate of photosynthesis*, a process through which plants *make their own food.* This is because *leaves contain chlorophyll that traps sunlight energy and stomata that allow entry of carbon dioxide a raw material for photosynthesis*. This reduced [illegible], hence low yields.

✓ Destruction of leaves also affected *gaseous exchange*, a process that *allows plants to take in carbon dioxide and release off oxygen through the stomata in leaves*. This *reduces the amount of carbon dioxide taken into the leaves, hence reduced photosynthesis.*

✓ Also feeding on leaves *affects transportation of materials* in a plant. This is because the vascular bundles in a leaf, that is the *xylem vessels which transport water and mineral salts to the leaf and phloem that aids in translocation of made food from leaves storage areas* are destroyed. This *reduces amount of water used needed for photosynthesis,* [illegible]

✓ Destruction of leaves *reduces transpiration in the plant*, a process which aids a plant to *absorb water and mineral salts and also cooling of the plant on hot days*, this *reduces uptake of water needed for photosynthesis and mineral salts needed for normal growth* of the plants, hence reduced yields.

The destruction by fall army worms above affects photosynthetic rate in a plant, leading to reduced formation of food in maize, leading to low yields.

Sand soil ***has large soil particles;*** that ***are loosely packed together; leaving large air spaces between the particles***; hence has high ***water drainage; and lower water retention capacity. Due to this, the soil drains off water very quickly and retains less water, which results into the following effects;***

- ✓ **Leaching of essential nutrients;** like nitrogen and magnesium required for ***making of chlorophyll*; that traps sunlight energy needed for photosynthesis**. The deficiency of these mineral salts resulted into yellowing of leaves and stunted growth; ***phosphorus and potassium*** important in ***root development***, who deficiency results into deformed roots , that reduce water and nutrient absorption, resulting into stunted growth.
- ✓ ***Excessive loss of water from soil*** to deeper layers, making it more difficult for plant roots to access water especially during dry periods, resulting into stunted growth.

(c) The following are the possible solutions on how to overcome the above challenges;

- ✓ *Application of organic manure such as composite manure, which improves on soil structure, and retains moisture and minerals in the top soil and greatly reducing the effects of drying and leaching.*
- ✓ *Mulching of the land by using dry plant materials, to reduce water loss from soil and also after decomposition; it forms humus which improves soil properties.*
- ✓ *Practicing regular irrigation, to allow presence of water to plants.*
- ✓ *Practicing crop rotation, this will break down the life cycle of fall army worm and also improves soil structure and increases nutrient availability in soil.*
- ✓ *Application of insecticides/pesticides; to kill the different stages of the fall army worms.*
- ✓ *Early inspection of crops; for early detection and elimination of fall army worm.*

ITEM 1.2

(a) The plant organs that were affected by the hailstorm include the following;

- ✓ ***Flowers of ground nuts, Leaves, Stems, Buds***

(b) The hailstorm affected the normal functioning of his crops in the following ways;

- ✓ *Destruction of leaves by hailstorm reduced the rate of photosynthesis in the crops, since amount of chlorophyll of chlorophyll that traps sunlight and number of stomata that allow in carbon dioxide reduced, which in turn reduces food manufacture in crops, affecting plant growth.*
- ✓ *The hail storm breaks the stems of crops, hindering/preventing proper transportation in plant, since it the phloem that translocates manufactured food from leaves to other parts and xylem that transports water and mineral salts from the roots to leaves are destroyed.*
- ✓ *Physical damage of flowers and their falling down, prevented pollination and fertilization to occur in plants; reducing formation of seeds, hence reproduction.*
- ✓ *When buds are damage, it affects growth and development of the plants, since buds give rise to new plant structures, so their destruction hinders growth of new plant structures like branches, leaves and flowers.*
- ✓ *Also destruction of leaves affects absorption of water and mineral salts from the soil by plant root hairs. This is because, leaves contain stomata, that allow transpiration, which in turn through transpiration pull enables water absorption, so destruction of leaves reduces transpiration and absorption in crops.*
- ✓ Etc.

(c)

- Ground nuts and sorghum did not regrow since they *are propagated by means of seeds*, and the plants were destroyed during flowering, hence there were no seeds formed already.
- Other crops like Irish potatoes, sugarcanes and banana plants were able to re-grow, since they can *undergo vegetative propagation* and are able to give rise to new plants as described below;

✓ Irish potatoes; these are propagated by means of *stem tubers*. The potato tuber ; (i) is *a short swollen fleshy underground stem*; that *stores much water and food required by the new sprouting plant to survival in drought*; (ii) has *many lateral buds* ('eyes') ; which develop *into new plant shoots with leaves for carrying out photosynthesis for the plant make food.*

✓ Sugar canes. These are propagated by means of *stem cuttings*. The stem; (i) *has numerous nodes with buds*; which *develop into new plant shoots with leaves that carryout photosynthesis for the plant make food*, (ii) has *succulent internode*; with *much stored food used for growth of the young new plant before it forms its own shoot with leaves and roots*; (iii) has nodes from *which numerous adventitious roots* develop from; that enable the new *plant to fix firmly into the soil and absorption of water and mineral nutrients need* for plant growth.

✓ **The banana plants**: these are propagated by means of *suckers*. (i) The suckers are *small new shoots that develop into new plants with leaves*; that *carry out photosynthesis for new plant.* The banana also, (ii) has underground stem, which remains in soil hence not damaged with *adventitious roots* that *absorb water and mineral nutrients need for plant growth*, (iii) *succulent leaves*; that *store much water and nutrients required for growth of new plant.*

ITEM 1.3

(a) The plant structures that were affected by rare appearances include;

✓ *Leaves. Stems. Roots*

(b) The appearances of cassava plants affected several processes in the plants that resulted into serious loses as explained below;

✓ The yellow leaves with mosaic patterns *reduced the rate of photosynthesis*. This was due to reduced amount of chlorophyll in *leaves that trap less sunlight energy required for photosynthesis. This* reduced *formation of photosynthetic products*, hence low yields.

✓ The curling of leaves reduced surface area for transpiration and light absorption. The reduced transpiration *reduced uptake of water needed for photosynthesis and mineral salts needed for normal growth* of the plants, hence reduced plant growth.

✓ The damage to stem of plants as shown in figure B, *affected transportation of manufactured food from leaves to tubers, since the phloem* was destroyed. This *reduced plant growth* hence low yields.

✓ Deformed tubers reduce the surface area for water and mineral nutrient absorption from soil. This *reduces uptake of water needed for photosynthesis and mineral salts needed for normal growth* of the plants, hence reduced yields.

(c) **Causes**: The appearances are caused by a virus called *cassava mosaic that causes cassava mosaic disease.*

Transmission: *The virus is transmitted by whiteflies.* When these feed on infected plant and then to healthy plant. they inject the virus into the plant's vascular system as they feed on plant sap. The virus then moves through the plant. infecting cells and causing the above symptoms. Also

the virus can be spread by *contact f infected plants with health ones* or *use of contaminated garden tools such as panga and hoes on health plants.*

The above problems can be prevented in future by;

- ✓ Planting of disease-resistant cassava varieties; to reduce transmission.
- ✓ Monitor fields regularly; for early detection and prevention.
- ✓ By spraying using insecticides or natural predators; to kill the *whiteflies* thereby reducing the transmission.
- ✓ Remove and destroy infected cassava plants by either burying or burning: to prevent the virus from further spreading.
- ✓ They should maintain physical distance between cassava fields and cassava plants: to minimize the spread of the virus by the vector.
- ✓ Proper sanitation and cleaning equipments such as hoes, panga etc. before and after use; to prevent virus transmission.
- ✓ Extension officers should educate/sensitize farmers on the new virus strain and management practices; to avoid further losses due to the virus.

ITEM 1.4.

(a) The processes include; **higher transpiration, lower water absorption.**

- ➢ The wilting was due to the fact that the seedlings *had not formed many new roots to enable them absorb much water*. Therefore the *rate of transpiration was higher than water absorption , hence the amount of water lost was higher than absorbed*. causing the cells loss water by osmosis, making them flaccid hence wilting.
- ➢ When the seedlings were watered in the evening. *they absorbed water by osmosis through their root hairs; the water was transported in the xylem up the seedlings* by capillarity force, cohesion tension force or root pressure. The water then entered the cells by osmosis. *causing them to be turgid*, thereby making leaves spread and stems hard and erect.

(b)

The causes of the different challenges faced by the tomato plants are explained below:

- ➢ The wilting of the seedlings after transplant;was caused by the higher rate of transpiration than water absorption from the soil.
- ➢ Failure to mulch the tomato plants, led to *exposure of the soil to direct sunlight*; that caused *water evaporation from the soil, reducing the amount of water in soil*. hence *leaving the top layer of soil dry*. This has the following effects;
- ✓ The drying of top layer of soil resulted into *soil compaction.* which *inhibits penetration of tomato roots to deeper layers,* which in turn reduces amount of nutrients absorbed by plants, causing stunted growth.
- ✓ Also water loss from the soil, *affects availability of nutrients* to the plant; since less nutrients will be dissolved in water for absorption by the roots. For example deficiency of *magnesium required for making of chlorophyll; makes leaves appear yellow, hence reduced photosynthesis*, due to reduced amount of light trapped by chlorophyll. lack *of phosphorus results into deformed roots*, which reduce water and nutrient absorption. resulting into stunted growth.
- ✓ Wilting of tomato plants after use of salty water was; due to the fact that *the soil solution was hypertonic in relation to cell sap of tomato plant roots*. This caused the root cells to *lose water by osmosis to the soil,* making cells to *become shrunk*. This *hindered absorption of water and mineral salts from soil by the tomato roots*. Due to the *higher transpiration rate*

than water absorption rate. the plants lost much water. hence wilted and dried due to *failure to absorb water yet much was being lost to atmosphere.*

(c)
The possible solutions to how Mr. Tumusiime can avoid the challenges in the future include the following:

- ✓ *Mulch the garden using dry plant materials*. to *reduce water loss from the soil*, hence keep moisture in the soil.
- ✓ *Ensure transplanting of seedlings in evening and immediately irrigate them*, to ensure root formation and *water absorption throughout the night before* being exposed to long sunny day.
- ✓ *Application of organic manure. to increase on soil fertility that allows proper growth of plants*.
- ✓ Ensure that water applied to the plants is not hypertonic; by obtaining it from fresh water bodies. to avoid wilting of plants.
- ✓ Manual covering of seedlings if too much sunshine is predicted that day to reduce on direct sunshine to seedlings that could cause excessive transpiration that could cause them to dry.

ITEM 1:5

(a) The processes affected include;

- ✓ Plucking off leaves affects *photosynthesis, transpiration. gaseous exchange and absorption of water and mineral salts.*
- ✓ Digging out roots affects *absorption of water and mineral salts*.
- ✓ Removing of barks of trees affects *translocation transportation of manufactured food from leaves to other plant parts.*

(b) The normal functioning of medicinal plants was affected in the following ways;

- ✓ When he plucks off leaves from medicinal plants, *the number of leaves reduce on the plant*, which in turn *reduces the rate of photosynthesis in the plant*, hence *reduced food manufacture*. This was due to *reduced chlorophyll amount on the plants that traps sunlight and number of stomata that allow entry of a raw material carbon dioxide*.
- ✓ Removal of barks off from trees; affects translocation in the plant. This is because *the phloem tissues in barks were destroyed;* which *prevents translocation of manufactured food from the leaves to other plant parts for either immediate use or storage.* Also removal of barks exposes the inner xylem tissues; making them prone to drying, which hinders transportation of water and mineral salts from roots to upper parts of the plant.
- ✓ When he digs out roots or uprooting out the plants, it *affects the process of water and mineral salt absorption from the soil*. This *reduces the amount of water for photosynthesis absorbed and mineral salts.* *This later resulted into wilting or drying of uprooted medicinal plants*.

(c) The medicinal plants were able to survive despite the poor harvesting methods of Mr. Joseph due to the following reasons.

- ✓ The trees *have buds at nodes*; that *sprout into new leaves that carry out photosynthesis to continuously make their food* and stem structures (branches) with *vascular bundles that transport materials all over the plant.*
- ✓ The un uprooted medicinal plants *develop more roots with numerous root hairs to replace those removed* that; that in *turn increases water and mineral salt absorption, ensuring further survival.*
- ✓ The medicinal plants *undergo faster mitotic cell division at the phloem and xylem tissues to replace the removed structures*; to ensure *continuous transportation of materials in the plants.*

ITEM 1.6

(a) (i) *Batch number 1/ the first batch of cassava* developed larger tubers. This is because of the following;

- ✓ The cassava plants have larger and longer leaves than those in second batch; *which increases the surface area for light absorption and carbon dioxide uptake through the stomata*. These also increase the rate of photosynthesis. Large size and long leaves *increases the amount of chlorophyll in the leaves, which trap more sunlight required for photosynthesis* and also *increases the number of stomata in leaves, which allows intake and presence of more carbon dioxide in the leaves*, which also in turn *increases the rate at which photosynthetic products* are formed, which when *transported through the phloem tissue to the storage sites,* increases the size of tubers.
- ✓ The plants were taller than those in second batch, implying possession of long internodes; *that allow proper positioning of the plant leaves to sunlight, increasing light absorption,* hence increasing photosynthesis.
- ✓ Due to large and long leaves with numerous stomata, *the rate of transpiration in these plants is high*, which in turn through *transpiration pull increases the rate of water and minerals salt uptake* by the roots, enabling plant processes occurring normally.

(ii) *Batch number 2/ the second batch of cassava;* this is because;

The cassava plants have smaller/narrow and shorter leaves. This *offers a small surface area over which transpiration occurs*. Narrow leaves *have few stomata;* hence *little water is lost in form of water vapour by evaporation/transpiration*. Since in drought conditions temperatures are so high during day, *there is increased transpiration from leaves, that usually results into water stress and wilting,* therefore possession of narrow leaves ensure *reduced water loss and hence survival of cassava plants in 2nd batch in drought.*

(b) The farmers can obtain high yields from the cassava plants from each batches during drought conditions through the following ways;

- ✓ *Mulch the garden using dry plant materials*, to *reduce water loss from the soil,* hence keep moisture in the soil.
- ✓ *Applications of organic manure, to increase on soil fertility and also improve soil structure that allows proper growth of plants in drought.*
- ✓ *Carrying out regular irrigation of the plants, to ensure availability of water in the soil, which allows proper plant growth.*
- ✓ *Planting of drought resistant varieties for each batch, to ensure thriving in dry conditions.*

ITEM 1.7

(a) Due to *brightly coloured petals, nice scent* and *large petals*, it made bees to visit these flowers, which later visited the flowering bean plants.

✓ Due to possession of pollen baskets on the hind limbs of bees, that aid in *carrying pollen grains and prongs on middle leg and* ***pollen brush on*** *tarsus of the hind limbs* that aid in scooping pollen from the pollen basket, when the bees visited the flowers of bean plants; *they carried ripe pollen grains from the anther heads to the mature stigma of bean flowers*; a process called *pollination.*

✓ When the *ripe pollen grain landed on mature compatible flower stigma*, it *absorbed water, nutrients and then germinated to form a pollen tube*; which *grown rapidly through the style via the micropyle to the embryo sac* ; under *the control of the pollen tube nucleus at the tip.*

✓ During growth of the pollen tube, *the generative nucleus divided by mitosis to form two male nuclei (male gametes); which lie behind the pollen tube nucleus.*

✓ When the pollen tube entered the embryosac through the micropyle; *the pollen tube nucleus degenerated and the tip of the pollen tube* had to burst, releasing the male gametes near the embryo sac which they enter.

✓ *One male nucleus fuses with the egg nucleus, forming a diploid zygote*, which divides *mitotically to form embryo*. The *second male nucleus fuses with the polar nucleus to form the seed primary endosperm*. The *ovary wall forms the fruit wall and the integuments form the seed coat.*

(b) The flowers planted near his gardens had following features that aided in increase of yields.

✓ They had *brightly coloured petals and a nice scent; that attracted pollinators such as the bees; near the garden; which aided pollination.*

✓ They also had *large petals; that made them to easily be seen/noticed by pollinators that later visited them and the bean plants.*.

✓ These features attracted the bees near his garden; which in the process, they ended up visiting the flowers of his bean crops, *enhancing pollination and fertilization, that increased formation of large bean pods than for Mr.Magala beans.*

(c)

✓ *Avoid using of broad insecticides, which may kill important pollinators.*

✓ *Application of organic manure and fertilizers to increase soil fertility*

✓ *Installing of bee hives on trees in the nearby trees, to keep them around their gardens in order to enhance pollination and fertilization.*

✓ *Planting of brightly coloured flowers near their gardens and within, to increase pollination chances.*

ITEM 1.8

(a)

Stem cutting for *planting cassava.* ***Suckers*** *for planting banana.* ***Bulbs/seeds*** *for planting onions and* ***Rhizomes*** *for planting ginger.*

(b)

Bulbs/seeds for planting onions

✓ *The bulb consists of thick fleshy leaves that store food used by the young plant before developing its own shoot and roots.*

✓ *Has buds, that grow into new shoots for carrying out photosynthesis to make food for the new growing plant*

✓ *Develops numerous adventitious roots at the base of the stem, that absorb water and mineral*

[illegible]

✓ [illegible]

[illegible]

✓ The cassava stem cuttings have nodes with buds which develop into new plants with leaves that carry out photosynthesis to make food for the new growing plant.

✓ Adventitious roots develop from the nodes providing firm support to the new plant and also absorb water and mineral salts from soil that ensure proper growth of the plant.

✓ The cassava stem cutting stores much food and water required by the growing young plant.

Rhizomes for planting ginger

✓ Have buds at nodes and their tips, which develop into new plants with leaves for photosynthesis.

✓ It's swollen and elongated underground stem; hence store much water and food that ensure survival of new plant in drought.

✓ Have nodes from which adventitious roots develop that aid in water and mineral absorption.

✓ Have buds for vegetative propagation. Have scale leaves for protection against desiccation.

Suckers for planting banana

✓ The underground stem develops numerous adventitious roots that absorb water and mineral nutrients needed for plant growth.

✓ The parent plant has bud that grow into small new shoots/plants with leaves; that carry out photosynthesis making food for new plant.

✓ The succulent leaves that store much water and nutrients required for growth of new plant.

(c) The other planting materials that the government can provide to farmers include the following:

Irish potatoes, Sweet potatoes, Sugar canes etc., refer to responses in item 1.2 above

NB: TRY OUT OTHER NUMBERS

SEMINAR ITEMS FOR ITEM 2

ITEM 2.1.

A 50 year old woman has been experiencing general body weakness, blurred vision, frequent urination, a lot of back pain and bone pain for now 3 years. For the last three months, she started experiencing difficulty in swallowing food due to her swollen neck. Her S.3 boy child has also for long complained of his failure to see very far objects. Due to her worsening healthy condition, upon visiting the hospital and medical checkup, the following results were obtained but the woman does not understand her health condition status.

Test	Normal body levels	Her body levels
Calcium ion levels (milligrams/deciliter)	8.5–10. 2	34
Blood glucose levels (mg/100cm^3)	90	140

Task

(a) Identify the health conditions in the family.

(b) Explain the possible causes of health statuses in the family.

(c) Describe the possible solutions on how to manage the health challenges in the family.

ST.AUSTIN'S COLLEGE KAKUNYU

ITEM 2.2.

Due to bad peer groups, Peter started smoking and taking of alcohol at age of 17 years. After taking of alcohol one weekend, while walking unsteadily along the road, a passing by heavy truck got a loud tyre burst which made Peter scared, his breathing rate and heart beat rate increased however he tried running but could not run away.

Task

(a) Explain how Peter's body coordinated from the time the loud tyre burst was produced until when he tried running.

(b) Describe the likely effects due to Peter's life style.

(c) Advise him on how to manage the likely effects from his life style.

ST.PETER S.S BUKALANGO

ITEM 2.3.

During frying of sauce, Molah added onions to hot cooking oil in a sauce pan. After a few seconds, she heard her phone ringing and ran to receive/pick it in main house, leaving what she was frying on fire. On coming back to kitchen, she found the onions getting burnt and rushed to withdraw the hot saucepan from fire using bare hands but immediately released it and in an attempt to escape, she fallen on the ground with the left arm first and immediately felt much pain and could not move the hand freely.

Task

(a) Describe how Molah's body coordinated to bring about her reactions from the time she noticed that the onions were burnt until when she escaped.

(b) Explain the possible cause of Molah's problems after falling down

(c) Suggest possible solutions on how she can overcome the problems.

ST.MBAGGA COLLEGE NADANGIRA

ITEM 2.4.

Joseph a youth in Kampala frequently urinates feels thirsty and hungry oftenly. During a peaceful demonstration to end corruption in parliament in July 2024, he heard a loud sound fired burets in air by a soldier. This caused increase heartbeat and breathing rate and also his eyes protruded and managed to escape into a building very fast.

Task

(a) Explain how Joseph's body coordinated from the time the loud sound was produced from fired burets until he escaped into a building.

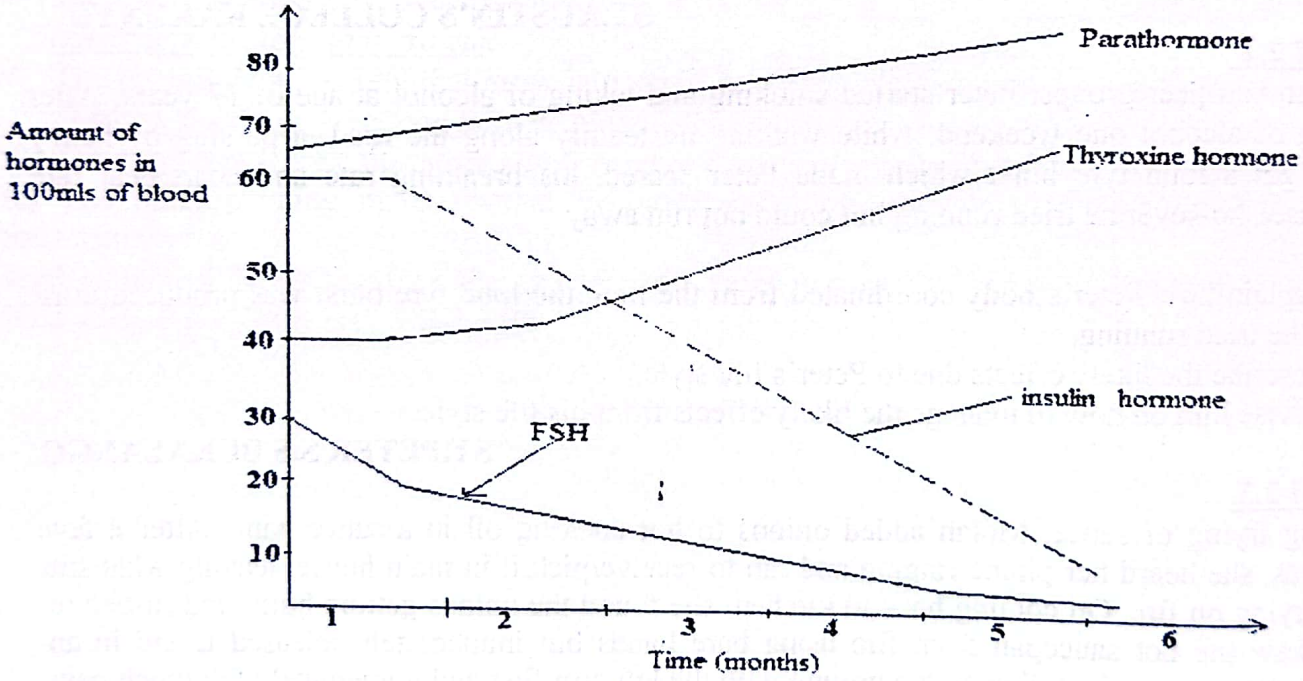
(b) Describe the cause of his health condition.

(c) Advise him on how he can manage his health condition.

ITEM 2.5.

Joan a 17 year old girl has been experiencing different health challenges for some time but the parents had resisted seeking medical attention. Due to the deteriorating life of their daughter, they took her to a medical expert who did not discover the immediately the possible causes but decided to monitor changes in amount of certain hormones in blood for six months due to the observed symptoms in her life. The results where illustrated as shown below.

Support material.



NB: FSH stands for follicle stimulating hormone

Figure1: A graph showing variation of the amount of different hormones in blood with time

Task

(a) Identify the glands that were affected in Joan.

(b) Explain the possible causes of the different hormonal changes in the body of Joan.

(c) Describe the likely effects to occur in Joan's body due to the changes in amount of each hormone in the body.

(d) Provide possible solutions to how Joan can manage the resulting health conditions.

ST.ELIZABETH NKOOWE SECONDARY SCHOOL.

ITEM 2.6.

Mr. Kennedy is a 57 year old man in Busunju town. He has been complaining of lower abdominal back pain and joint pain. One day, due to faulty wiring in the house, he saw electric sparks and immediately jumped out of the house. He accidently hit his upper leg on a metallic pipe and started experiencing much pain and could not even stand. His 2 year old boy is stunted in growth, mentally retarded with short stature and sunken eyes and he is not certain of the cause of his child`s complications.

Task:

(a) Explain how Mr. Kennedy`s body coordinated to bring about his reactions from when he saw the electric sparks until he jumped out of the house.

(b) Explain the causes of the healthy conditions in the family.

(c) Describe how they can manage the health conditions in the family.

ST.CHARLES LWANGA INTERNATIONAL S.S

ITEM 2.7.

In a research conducted about old age health by Makerere public health team, the following were recorded in their report.

Sample population	Health condition	Men	Women
170 people	Osteoporosis	34	102
170 people	Diabetes mellitus	70	96
170 people	Myopia	80	90
170 people	Obesity	3	23

They attributed most health conditions to life style of the people

Task

(a) Explain the causes of the identified health conditions in old people.

(b) State how each health condition was identified in the sample population used.

(c) Suggest possible solutions on how to manage the health conditions in the old people.

PEARL HIGH SCHOOL NANSANA

ITEM 2.8.

Jimmy is a short S.5 student in a certain school. Due to peer influence by colleagues, he started smoking marijuana and drinking of alcohol but three weeks back, he started experiencing healthy complications in his body and also when he was made to sit on a front desk, he could not clearly see work written on the blackboard hence preferred sitting at the back.

Task

(a) Mention the likely organs that are affected in Jimmy's body and state the roles of these organs play in the body.

(b) Describe the possible causes of Jimmy's health complications.

(c) Explain the strategies for managing the complications in his life and also improve his life style.

EXPECTED RESPONSES

ITEM 2.1.

(a) The health conditions include the following:

Mother has *diabetes mellitus, goitre and osteoporosis*

Child has *short sightedness/myopia*

(b) The possible causes of the health statuses in the family include the following:

✓ The child can *only see near objects* but cannot see clearly distant/far objects, hence has myopia, an eye defect caused by either *having too long /large eyeball or a permanently thick lens/too curved lens.* This makes *light rays from distant objects to be refracted more/greatly, hence focused before/ in front of the retina*, and image on retina is not clearly seen/blurred.

✓ She has a *high calcium ion levels in her blood than the normal;* which signifies *osteoporosis,* a hormonal disorder caused by *hyper secretion of parathormone in parathyroid gland;* which results into *excessive movement of calcium ions from the bones to blood;* thereby increasing calcium ions in blood thus weakening bones and making them more susceptible to fractures.

✓ *Her blood glucose levels are beyond normal;* a condition called *hyperglycemia.* This results into *diabetes mellitus;* which may be caused by either *failure of the beta cells of pancreas to secrete insulin hormone* or *failure of liver and muscle cells to recognize and respond to secreted insulin hormone*. Hence no regulation/lowering of glucose levels back to normal.

✓ Swelling of neck; signifies goitre; caused by *deficiency in iodine in the body*, that results into *enlargement of the thyroid gland; in an attempt to increase thyroxine secretion* or *thyroid gland inflammation or thyroid gland cancer.*

(c) The possible solutions to manage the health challenges in the family include the following:

Myopia

✓ This can be corrected by *wearing spectacles with concave/diverging lens;* which *diverges the light rays from far distant objects slightly, enabling the eye lens to focus them correctly onto the retina.*

Diabetes mellitus;

✓ *Regular checkups with health care providers; to monitor the glucose levels.*

✓ *Regular physical exercise, **which** improves on insulin sensitivity by liver and muscle cells and also to use excess blood glucose during respiration ; in order to lower the levels back to normal.*

✓ *Reducing intake of sugary foods and unhealthy fats; **in order** to keep blood glucose levels to the normal levels.*

✓ *Taking insulin injection/tablets every after a carbohydrate meal; to regulate blood glucose levels to the normal.*

✓ *Avoid tobacco use and limit alcohol consumption, **to** avoid liver damage.*

✓ *Pancreas transplants,* in case other treatment options have failed; *to enable insulin secretions that enable lower blood glucose levels back to normal*

Osteoporosis

✓ *improve her diet by eating foods with more vitamin D such as dairy products, leafy greens; since ; vitamin D aids in the absorption of calcium in body*

✓ *Regular exercise like walking, jogging, dancing or weightlifting; to make bones strong*

✓ *Avoid smoking and excessive alcohol consumption; since it weakens the bones.*

Goitre

- ✓ *Intake of iodine in diet, by* eating foods rich in iodine such as *dairy products and iodized salt, to increase iodine amount in body needed for manufacture of thyroxine hormone to overcome goitre.*
- ✓ Also *intake iodine supplements; to increase iodine amount in bod*
- ✓ *Surgery by removing a part or all part of thyroid gland, and replace it with one in good condition; to overcome its enlargement.*

ITEM 2.2

(a) The following occurred;

- ✓ The loud sound waves from a bursting tyre were *collected, received and concentrated into the ear by both pinnae;* and then *transmitted directed to the ear drum/tympanic membrane through the auditory canal.*
- ✓ *This causes the eardrum to vibrate, and the vibrations of the eardrum were transmitted to the three ear ossicles;* which also *vibrated and transmitted their vibrations starting from the malleus, incurs and finally the stapes to the oval window that leads to the inner ear.*
- ✓ *The oval window vibrated and generated pressure waves in the perilymph of the vestibular and tympanic canal of the cochlea.*
- ✓ *These pressure waves were then transmitted across the membrane of the middle canal of cochlea, and then transmitted to the endolymph (fluid in middle canal of cochlea).*
- ✓ *The vibrations of the endolymph later caused the sensory hair cells to be displaced by tectorial membrane and then stimulated to generate an impulse, which was sent/carried to the brain by the auditory nerves for interpretation.*
- ✓ *After interpretation, a sensation of sound was produced and detected as danger hence was sacred.*
- ✓ The brain then sent *impulses to the muscles of the legs and hands through motor nerve, to contract and relaxes causing faster movement.*
- ✓ The brain also *sent nerve impulses to the medulla of adrenal gland;* stimulating *it produce adrenaline hormone into the bloodstream* which is transported to different parts of the body. It caused **(i)** *an increase in heart beat rate; to pump more blood with glucose and oxygen to the muscles for respiration;* **(ii)** an *increase in breathing rate; to allow in more oxygen for energy production during aerobic respiration and removal of excess carbon dioxide from body.*
- ✓ But since he had taken *alcohol which affects the cerebellum in the brain; that controls muscular movements and body balance, he could not run away well due to the unsteady movements.*

(b) The likely effects due to Peter`s life style of smoking and taking of alcohol at a young age include the following;

Effects due to alcohol consumption include;

- ✓ *It may cause liver, brain and pancreas damage.*
- ✓ *It may cause mental health disorders such as anxiety, depression etc.*
- ✓ *Result into cardiovascular problems such as high blood pressure and heart failure.*
- ✓ *Causes nutritional deficiencies due to reduced appetite.*
- ✓ *Increased rate of accidents and injuries or even death since it affects the cerebellum that controls body balance.*
- ✓ *Results into increased risks of infection, since it suppresses the body's immunity.*

Goitre

- ✓ *Intake of iodine in diet, by* eating foods rich in iodine such as *dairy products and iodized salt, to increase iodine amount in body needed for manufacture of thyroxine hormone to overcome goitre.*
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- ✓ *Causes nutritional deficiencies due to reduced appetite.*
- ✓ *Increased rate of accidents and injuries or even death since it affects the cerebellum that controls body balance.*
- ✓ *Results into increased risks of infection, since it suppresses the body's immunity.*

- ✓ *It results into social problems like loss of jobs. family divorce. domestic violence and poverty.*
- ✓ *Leads to stigma and social isolation from other people.*
- ✓ *Leads to reduced/decreased self-esteem and confidence.*

Effects of smoking

- ✓ *It affects respiratory organs mainly the bronchi. alveoli. which leads to diseases such as emphysema. lung cancer and bronchitis.*
- ✓ *Leads to vasoconstriction (narrowing) and hardening of blood vessels. which result into stroke and heart attack and hypertension.*
- ✓ *Increases risks off infections like pneumonia and influenza.*
- ✓ *Leads to mental disorders like anxiety and depression*
- ✓ *Leads to gum diseases, tooth decay and hence results into teeth loss.*
- ✓ *It causes premature aging. as it results into wrinkles and weakened immune system.*
- ✓ *Can result into osteoporosis and hence fractures*
- ✓ *Also reduces reproductive fertility.*
- ✓ *Social effects include. it leads to social isolation. stigma. relationship problems. work related issues like decreased productivity and low self-esteem*
- ✓ *etc.*

(c) He can overcome the likely effects in the following ways.

- ✓ Avoid smoking and alcohol consumption, to avoid damage to body organs.
- ✓ Seeking for professional help from counselors by counseling and guidance.
- ✓ Should seek medical help in the treatment of damaged organs.
- ✓ Should engage health activities like engaging in physical activities like football.
- ✓ Avoid bad peer groups. to stop their influence.

NB: Make more research.

ITEM 2.3

(a)

- ✓ *Light rays from onions in saucepan entered the eye. They were refracted in a series starting by the cornea, aqueous humour, lens, and vitreous humour which finally refracted the light and focused it to the retina, making an image on the retina.*
- ✓ *The photoreceptors in the retina were then stimulated and produced nerve impulses.*
- ✓ *These travelled along the optic nerve to the brain; where interpretation of the image was made, that thee onions were getting burnt.*
- ✓ *The brain sent impulses through the motor neurone to triceps muscles to contract and biceps muscles to relax causing the hands to straighten and later biceps muscles to contract and triceps muscles relaxed to withdraw the saucepan from fire.*
- ✓ *To release thee sauce pan immediately, it was due to touching the hot saucepan with bare fingers. This made the heat and pain receptors in the skin to be stimulated; which immediately generated impulses that were carried by the sensory neurons via the ventral route to the grey matter of the spinal cord.*
- ✓ *The impulses in the sensory neuron were then transmitted across a synapse to interneuron and then to the motor neuron across another synapse.*
- ✓ *The impulses then left the spinal cord along the motor neurone to effectors; biceps and triceps muscles of the arm via the dorsal root of the spinal cord.*

✓ *The biceps muscles contracted and triceps muscles relaxed causing rapid withdrawal of the hands from the hot saucepan causing it to fall down.*

(b) Molah's problems after falling down was much pain and failure to move it freely.
Falling down could have caused stress on muscles and bones causing them to get fractured. Since she fallen down with left arm first, the much pain felt could be due to fracture of the humerus, ulna or radius bones ; dislocation of joints; overstretching or tearing of ligaments; nerve compression or damages, hence much pain and could not move the hand freely.

(c) The possible solutions on how she can overcome the problems include;
- ✓ *Taking of medication like pain killers; to relieve pain.*
- ✓ *Medical checkup through the scans to detect the extent of the injury.*
- ✓ *Physical therapy;*
- ✓ *Ensure adequate intake of calcium and vitamin D, to allow bone strength.*
- ✓ *Resting the affected area and apply ice to avoid swelling*

ITEM 2.5.

(a)

The glands that were affected in Joan include the following;
- ✓ ***Parathyroid gland**: that produces parathormone.*
- ✓ ***Thyroid gland** , that produces thyroxine hormone*
- ✓ ***Pancreas** which produces insulin hormone*
- ✓ ***Anterior pituitary gland**, which produces follicle stimulating hormone.*

(b) The possible causes of the different hormonal changes in the body of Joan include the following;
- ✓ *From 1st month to 6th months, the amount of parathormone increased gradually in her blood. This was due to over stimulation of Parathyroid gland, to over secrete parathormone in blood. This was caused by either enlargement of parathyroid gland or deficiency of calcium or vitamin D in blood.*
- ✓ *The amount of insulin hormone in blood decreased gradually from 2nd month to 6th month. This could be due failure of beta cells of islets of Langerhans of the pancreas to secrete insulin hormone into blood, or destruction of the beta cells by the immune system a condition called autoimmunity.*
- ✓ *The amount of thyroxine hormone increased in the blood from 2nd month to 6th month. This is caused due to over secretion of thyroid stimulating hormone into blood by anterior pituitary gland, which later leads to over stimulation of thyroid gland to over produce thyroxine hormone into blood, causing it amount to increase.*
- ✓ *The amount of FSH reduced in blood from 1st month to 6th month. This could be due to failure of the hypothalamus to secrete Gonadotrophin releasing hormone,* which *stimulates the anterior pituitary gland to secrete less FSH into blood, hence reduced amounts of FSH in blood.*

(c) The likely effects to occur in Joan's body due to the changes in amount of each hormone in the body.
- ✓ Hyper secretion of parathormone in blood results into*; excessive movement of calcium ions from the bones to blood.* This leads to *loss of bone mass; weakening of bones, making them more susceptible to fractures, bone and back pain, loss of height over time and stooped posture a condition called osteoporosis.*

- ✓ Reduced insulin levels in blood, *result in increased blood glucose levels above the normal,* which in turn *results into diabetes mellitus, that results into Increased hunger, Frequent urination; Increased thirst. Fatigue Blurred vision; Slow healing of the cuts and presence of glucose in urine*
- ✓ Over production of thyroxine hormone into blood, *results into hyperactivity characterized by; an increased metabolic rate, Increased heart rate, raised body temperature, Underweight, and extreme irritability*
- ✓ Reduced levels of FSH in blood results into *reduced growth and development of the graafian follicles in the ovaries; and reduced production oestrogen by ovaries hence slow repair and healing of the uterine wall after menstruation. This in turn reduces ovulation and changes in menstrual cycle in Joan.*

(d) She can manage the resulting health conditions by;

- ✓ *Seeking medical help from health providers, to overcome malfunctioning of pituitary gland and also to monitor the glucose levels.*
- ✓ *Regular physical exercise, which use excess blood glucose during respiration ; in order to lower the levels back to normal.*
- ✓ *Reducing intake of sugary foods and unhealthy* fats; in order *to keep blood glucose levels to the normal levels.*
- ✓ *Taking insulin injection/tablets every after a carbohydrate meal; to regulate blood glucose levels to the normal.*
- ✓ *Eating foods with more vitamin D to increase the absorption of calcium in body and into the bones.*
- ✓ *Regular exercise like walking, jogging, dancing or weightlifting; to make bones strong*
- ✓ *Treatment of disorders of specific glands, to reduce their effects.*

TRY OUT OTHER ITEMS

SEMINAR ITEMS FOR ITEM 3

ITEM 3.1

Mr. Umar is a man married with two wives, Janat and Miriam but both produced girls only. He promised to divorce them if none of them bears a boy child. Janat is now pregnant for 6 months but still after a scan analysis for the sex of the foetus, it was discovered to be a girl. Due to the stress, she has oftenly missed many antennal care visits. The first born of Miriam has for long experienced anemia, painful episodes and foot swelling and on diagnosis in hospital, the child had sickle cell anemia, yet Umar and Miriam are normal. Mr. Umar doubts being the farther to the child.

Task:

(a) Explain the genetic possibility of Umar being the father of Mariam's first born and also being responsible for the sex of the family children.

(b) Describe the likely challenges to be faced by Mariam's first born and Janat's action to her life and foetus.

(c) Advise the family on how to overcome the challenges they are facing.

DIVINE COLLEGE SCHOOL WAKISO

ITEM 3.2

Joan when in her S.6 vacations. she had two boyfriends. Tom and Kennedy. When she missed her periods for a month and started experiencing continuous vomiting and body fatigue. A pregnancy test was positive but both boyfriends denied the pregnancy. Tom claimed to having used a condom whereas Kennedy withdrawal method. Due to fear of her parents, she escaped home for 2 years and produced a baby boy. Blood group tests for all revealed blood groups A, AB, B and O for Joan, Tom, Kennedy and boy child respectively. The child has stunted growth and always sickly as Joan does not know how to care for him and the right diet for her and the child.

(a) Describe the events that occurred till Joan experienced continuous nausea, vomiting and body fatigue.

(b) Explain genetically the father of the child.

(c) Advise Joan on the proper care for herself and the baby to ensure normal growth.

HAWA SECONDARY SCHOOL

ITEM 3.3

Benitah a 16 year old senior 3 girl with a blood group A got pregnant in 2020 during the lock down. When asked the man responsible for pregnancy, 'John a senior 6 boy' she replied but john denied and due to fear of imprisonment, he escaped from the village for two years. After birth, the doctors claimed that the baby boy was an albino with blood group O yet Benitah and John both looked normal and healthy. John is blood group B but when he heard that Benitah gave birth to an albino child. he denied that in their clan; nobody had ever produced an albino and now Benitah is stranded.

Task

(a) Explain the genetic possibility of John being the father of the baby.

(b) Describe the likely challenges to be faced by both John and Pauline and their child

(c) Suggest the possible advise on how other youths can prevent the above challenges.

AMAHORO SECONDARY SCHOOL

ITEM 3.4

Pamela a 15 year girl. ever since the joining of secondary level; she has been experiencing different physical and behavioral changes in her body. Last month, she was suspended from school for two weeks after being caught with a senior six boy in his class. For this month, she has missed her periods, experiences nausea and body fatigue though not sure of the cause. After tests in clinic, HCG was found positive but she denies pregnancy. The senior six boy also started experiencing painless sore on his genitals, skin rash and swollen lymph nodes.

Task

(a) Describe the physical and behavioral changes that occurred in the girl and how they could have led her into the challenges.

(b) Explain the events that resulted into the changes in Pamela's body from the time she was caught with a senior six boy up to when her urine tested HCG positive.

(c) Describe the possible challenges that the two people are likely to face and advise other youths how they can prevent the above challenges.

NKOOWE HIGH SCHOOL

ITEM 3.5

Betty and Francis were happily married with two children. James their first born was diagnosed with bleeder`s disease yet Joan the second born is normal. Francis denied being the father to James since he had never seen such a condition in their family. Due to misunderstandings in the family, he started engaging in extramarital relationships, from which he contracted HIV. The family is now stressed with managing multiple health problems.

Task:

(a) Using scientific facts clearly prove to Francis the possibility of him producing a son with bleeder`s disease with Betty.

(b) What are the likely effects of the James` condition on his life?

(c) Describe to Francis how he might have acquired his health condition and suggest possible solutions on how to manage it.

ST.JOHN'S SENIOR SECONDARY SCHOOL WAKISO.

ITEM 3.6

Mr.Mukisa and his wife are married for now three years with two children Claire and Charles. When one year old, Charles started experiencing recurrent painful episodes, fatigue, anaemia and foot swelling but not much affected by malaria as Claire. Due to the fact that Mr.Mukisa has no health complications, he has been for long doubting the paternity of the children. For the past 5 months, he started engaging in extramarital affairs and he started experiencing health complications characterized by swollen lymph nodes, fever, sore throat, red itchy skin rash, and painless ulcer (**chancre**) on his penis and mouth but is not certain of the cause of the health challenges in the family.

Task

(a) Explain the possible causes of the health challenges in the family.

(b) Describe the genetic processes to show that the parents are responsible for the genetic status of Charles.

(c) State why Charles is not much affected by malaria as Claire.

(d) Describe the possible solutions on how the family challenges can be overcome.

ST.ELIZABETH NKOOWE SECONDARY SCHOOL

ITEM 3.7

Namagembe and Richard both physically look normal but produced a Sickler child called Lavia who is currently 6 months. During pregnancy, Namagembe never visited hospital for checkup and at birth, the baby had low birth weight than expected of a normal new born and has frequently been falling sick and Namagembe is still experiencing recurrent pain. The father is wondering what could be the health issue yet their first born was normal. Also when blood test was carried out, the parents were discovered HIV positive.

Task:

(a) Explain to the parents how the genetic conditions in their children rose?

(b) Describe the possible causes of the current health status of Lavia and the parents.

(c) Provide recommendations for the family to address the health issues in the family.

OXFORD HIGH SCHOOL KYEBANDO

ITEM 3.8

Irene got pregnant a few months after she experienced her first menstruation and the man responsible for her pregnancy has warned that he will take responsibility only if the result is a male child. She is worried about the sex of her unborn baby since she cannot manage to provide the necessities without the man's support.

Task:

(a) Explain to Irene the possibility of her unborn baby having the desired sex.
(b) Describe the challenges she is likely to experience due to her condition regarding her age.
(c) Advise both parents on how best they can care for their baby after birth.

HIGHFIELD HIGH SCHOOL OF EAST AFRICA.

ITEM 3.9

Benah an S.2 student aged 15 years claimed to have been raped by Peter. After one month, she started vomiting and later was discovered pregnant and also was HIV positive. However Peter denied the pregnancy and abandoned her. She delivered a child who is HIV positive, mentally retarded, with a short neck and flat face. The Doctor claimed that the child's health condition is due to a genetic disorder.

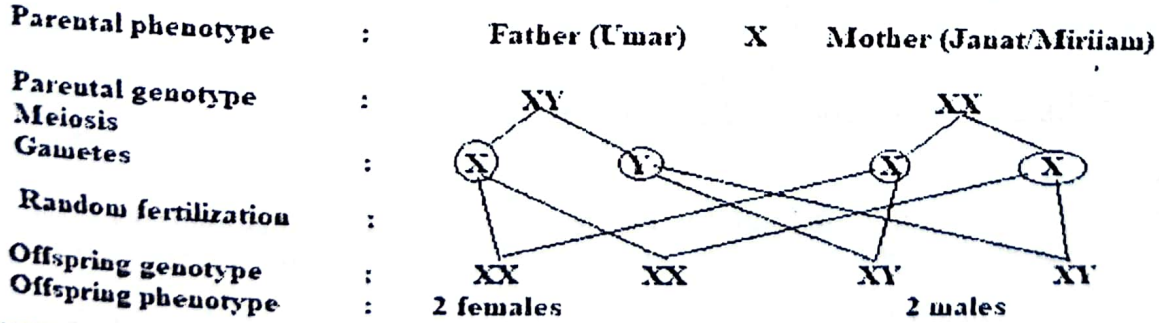
Task:

(a) Explain how the child's genetic condition comes about.
(b) What are the likely challenges that Joyce faced before and after delivery?
(c) How can Joyce ensure the child lives a healthy life?

EXPECTED RESPONSES

ITEM 3.1

- *The sex of a child is determined by a pair of sex chromosomes and these are X and Y. Females have sex chromosomes of XX, hence produce ova carrying only X chromosomes while males have sex chromosomes of XY and produce sperms which carry either X or Y chromosomes. After unprotected sexual intercourse and copulation, the sperms released into the female body swim to the oviduct by aid of their tail for fertilization to occur; whereby if a sperm cell carrying the X chromosome fuses with an ovum carrying the X chromosome, a zygote with the genotype XX is formed and will develop into female child and if a sperm carrying the Y chromosome fuses with an ovum carrying the X chromosome, a zygote with the genotype XY is formed and will develop into a male child as illustrated below;*



Therefore, Mr. Umar through the sperms he ejaculates during copulation, determine the sex off the child not the wives since for them only carry an ovum of ONLY X chromosome.

- *Sickle cell anemia is due to point mutation in the gene that codes for haemoglobin; which results into changing the normal structure of the red blood cells to a sickle shape and are rigid. This makes them get stuck in small blood vessels, hence blocking blood flow to organs*

and tissues. resulting into reduce oxygen delivery and painful episodes and also they cause inflammation, that result into swelling.

The sickle cell anemia is an autosomal recessive genetic disorder. Therefore since Umar and Miriam appear normal but *first born is Sickler, then both parents are carriers for sickle cell trait (heterozygous normal), where each parent has a normal allele and one sickle cell allele. This therefore implies that the child obtained/inherited two abnormal haemoglobin genes/alleles from the parents as illustrated through a genetic cross below:*

Let H represent allele for normal haemoglobin/trait

Let h represent allele for abnormal haemoglobin/ sickle cell

Parental phenotype : **Normal carrier male (Umar) X Normal carrier female (mariam)**

Parental genotype : **Hb** **Hb**

Meiosis

Gametes : **H** **h** **H** **h**

random fertilization :

F1 genotypes : **HH** **Hh** **Hh** **hh**

F1 phenotypes : **Normal** **Carriers** **sickler**

Therefore from the genetic cross, there is 25% of Umar being the father of Muriam's first born.

(b)

Challenges faced by first born

Since the child is Sickler, she is likely to face the following challenges;

- ✓ *Mental disorders such as depression and anxiety, due to much pain.*
- ✓ *Likely to have damaged organs especially kidneys, liver, spleen, lungs and eyes.*
- ✓ *Recurring episodes of acute pain*
- ✓ *Fatigue due to anaemia*
- ✓ *Increased risks of infections to the child*
- ✓ *Social stigma and isolation in society*
- ✓ *Financial burdens due to high medical bills.*

Challenges faced by Janat and foetus due to her actions.

Since she oftenly missed many antenatal care visits. the following challenges are likely to occur;

- ➢ **To fetus;**
- ✓ *Increased risk of fetal mortality and stillbirth; due to absence of regular check-ups that leads to undiagnosed complications, which lead to increased risks of still birth (birth of dead fetus).*
- ✓ *Increased risk of neonatal infections, more so if some infections are not treated in mother, they be transmitted to child, like syphilis, HIV etc.*
- ✓ *Increased risks of premature (preterm) birth due to delayed detection and treatment of fetal abnormalities.*

- ✓ *Can lead to low birth weight, due to poor maternal nutrition, inadequate prenatal care, maternal health conditions etc during pregnancy that could have affected Foetal growth and development in womb.*
- ✓ *Leads to developmental delays and intellectual disability: since it can result in undiagnosed and untreated conditions.*
- ✓ *Can cause congenital abnormalities. Due to failure of early detection of such abnormalities, they affect the fetus e.g heart defects etc.*
- ✓ *Etc.*

➢ **To Janat(mother)**

- ✓ *Lack of prenatal care, so due to failure of antenatal visits, she missed prenatal checkups during pregnancy hence poor monitoring of pregnancy that may result into different complications to both.*
- ✓ *Leads to increased risks of cesarean section (C-section). This is because of failure of regular checkups that would discover underlying complications like fetal growth restriction, placenta previa and un managed chronic conditions like hypertension, diabetes, that result into difficulty in delivery; hence C-section*
- ✓ *Increased risk of maternal mortality, due to increase in risks of life-threatening complications.*
- ✓ *May result into unmanaged chronic conditions previously existing such as diabetes, high blood pressure or asthma that may worsen during pregnancy if unmanaged causing many complications.*
- ✓ *Can result into placental abruption. Failure of antennal visits results may result into a serious medical condition where the placenta separates from the uterus before the bay is born, leading to fetal distress, bleeding, back pain and painful uterus.*
- ✓ *Poor pregnancy outcomes like premature births and low birth weight.*
- ✓ *Mental health issues such as anxiety and depression.*
- ✓ *Increased risks of infections*
- ✓ *Can lead to unmanaged bleeding after delivery called postpartum hemorrhage.*
- ✓ *May lead to increased risks of prolonged labour*

(c) The family can prevent the challenges they are facing in the following ways.

- ✓ *Genetic counseling by the members, to understand the risks of passing genetic conditions to children and sexual status of their children. This will reduce conflicts in family and also enable reduce risks of inherited disorder in future pregnancies.*
- ✓ *Provision of pain killers/medicines, to relieve painful episodes.*
- ✓ *Blood transfusion, to overcome anaemia.*
- ✓ *Feeding of the child on a balanced diet, containing foods with iron, to aid in formation of haemoglobin like beet root etc.*
- ✓ *Iron supplements , to facilitate production of haemoglobin in RBCs.*
- ✓ *Regular prenatal visits. Janat should be encouraged to regularly go for antenatal care visits to health care providers in order to; allow early detection and management of pregnancy complications, fetal abnormalities, fetal growth and development and also prevent preterm birth.*
- ✓ *Regular exercise to improve on circulation.*
- ✓ *Ensuring proper rest to the child.*

ITEM 3.2

(a) The events that occurred till Joan experienced continuous nausea, vomiting and body fatigue as described below:

Depending on the birth control method used, Joan had sex intercourse with them. Upon ejaculation, the released sperms into her vagina swam by aid of their tails through the fluid. The cervix relaxed and opened to allow in sperms that later continued swimming to her oviduct where fertilization of her ovulated egg from the ovary occurred. This led to formation of zygote, that underwent cell division by mitosis and was moved by the action of cilia along the oviduct to the uterus where implantation occurred, a process through which an embryo/foetus gets attached to the wall of the uterus by the placenta through the umbilical cord. The placenta then secretes human chorionic-Gonadotrophin (HCG) which prolongs the activity of the corpus luteum. Due to the hormonal changes that occurred in Joan's body, they caused many body changes such as vomiting, nausea and body fatigue.

(b)

The child having blood group O means, the parents have heterozygous blood groups, hence baby boy obtained O from each parent, as shown below,

Let A represent allele for antigen A on red blood cells

Let B represent allele for antigen B on red blood cells

Let O represent allele for absence of an antigen A or B on red blood cells

Parents ***Mother (Joan)*** ***Father (Kennedy)***

parental phenotypes : Blood group A X blood group B

Parental genotypes : AO BO

Meiosis

Gametes : A O B O

Random fertilizaion:

offspring genotypes: AB AO BO OO

Since the child has blood group OO and Tom has blood group AB, while mother is blood group A, there is no possibility of Tom producing a child with blood group O but a cross between Joan and Kennedy gave one offspring with blood group O, therefore Kennedy is the father of baby boy.

(c) Advise Joan on the proper care for herself and the baby to ensure normal growth.

The stunted growth and falling sickly of the child could be due to malnutrition and poor care therefore, she should;

- ✓ *Ensure regular medical check-ups and consultations; to address underlying health conditions.*
- ✓ *Provide a balanced diet rich in essential nutrients like proteins for tissue growth and development, vitamin C to boost immune system etc, to overcome infections.*
- ✓ *Maintain good hygiene by regularly changing diapers, cleaning the baby's genital area, wash their hands and body, to prevent easy disease attack.*

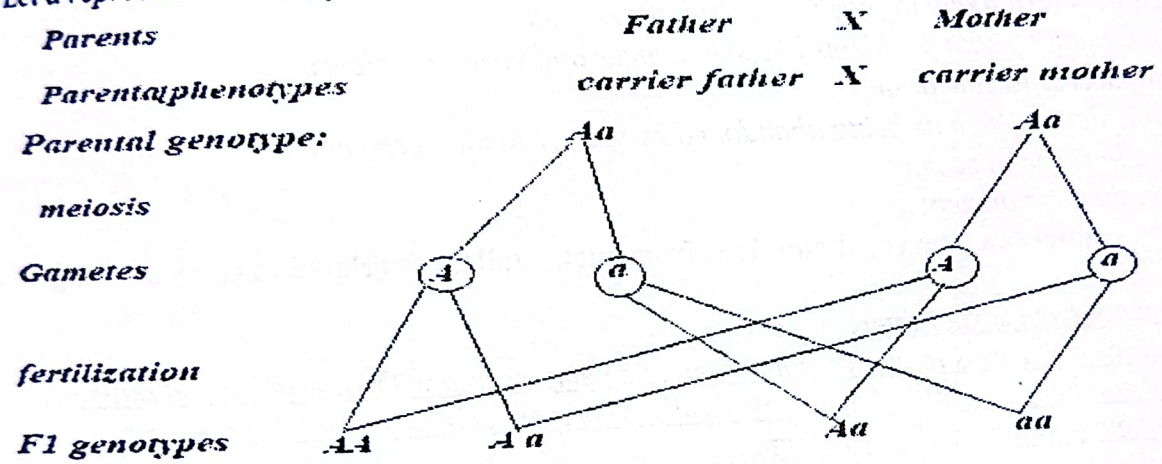
✓ *Ensure proper sleep and rest by creating a safe sleep environment.*
✓ *Ensure effective vaccinations, by adhering to the dates; to protect the bay from diseases.*
✓ *Emotional support to child by offering love, affection to the child.*

ITEM 3.3

(a).

➢ *The child is an albino due to failure of his body to produce skin pigment called melanin, resulting into light coloured skin, white hair and pink eyes.*
Albinism is caused by a recessive gene, implying that a child inherits one mutated gene from each parent and since both parents appeared normal, they may be heterozygotes/carriers for albinism.

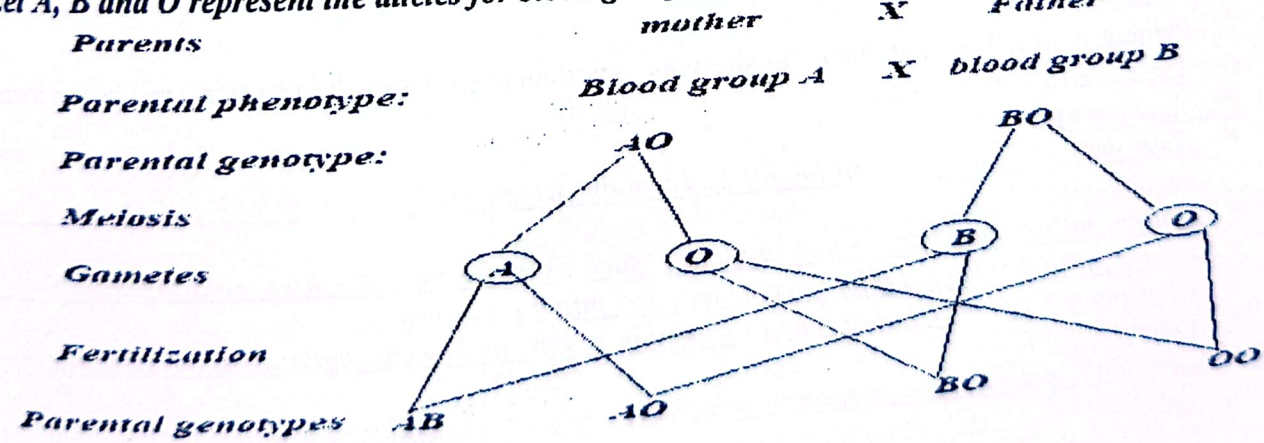
Let A represent the allele for normal skin colour
Let a represent the allele for no skin colour.



F1 phenotypes: 3 normal skin colour and 1 child is albino.
The appearance of both parents normal, doesn't rule out the possibility of John being the father.

➢ Since the blood group of mother and father is A and B yet the baby is of blood group O, then there is a possibility that both where *heterozygous for their respective blood groups*.
Therefore the father is blood group BO and mother is blood group AO. The possibility of John being the father is as shown,

Let A, B and O represent the alleles for blood group A, B, and O respectively.



From the genetic crosses above, john is likely to be responsible for the pregnancy and hence the father to the baby, since there is 25% possibility of him producing an albino child with blood group OO.

(b)

Since john and Pauline are young adolescents, they are likely to face the *following challenges.*

- ✓ *School dropout, hence low academic achievements.*
- ✓ *Low self-esteem in society*
- ✓ *Social stigma and isolation like the girl will face more of social critisms from peers, family members and community.*
- ✓ *Emotional challenges like anxiety, stress and depression*
- ✓ *Limited access to resources like lack of financial support for the child and their family.*
- ✓ *Health risks like complications during pregnancy by the girl*
- ✓ *Increased risks of domestic violence.*

The child is also likely to face some challenges like;

- ➢ *Will face many health problems like skin cancer and vision problems.*
- ➢ *Lack of access to education*
- ➢ *Social isolation, such as being abandoned by society/family members*
- ➢ *Low self-esteem in society*
- ➢ *Depression and anxiety*

(c) Other youths can prevent themselves from such challenges related to early marriage by;

- ✓ *Abstinence from sexual intercourse*
- ✓ *Ensuring easy access to quality education, to be empowered with knowledge and skills.*
- ✓ *Use of condoms and other birth control pills to prevent contracting early pregnancy*
- ✓ *Thorough guidance and counseling*
- ✓ *Sexual education and awareness, by providing information about the risks of early marriage.*

The family can overcome challenges by;

- ✓ *Genetic guidance and counseling, to understand the genetic implications and risks behind albinisms.*
- ✓ *Raise awareness about albinism, to reduce stigma.*
- ✓ *Protecting of the child from direct sunshine by either clothing or keeping in shade; to prevent sun damage.*

ITEM 3.4

(a) Pamela is in adolescent stage, so she was experiencing intense the physical and behavioral changes as described below:

Physical changes

- ✓ *There was rapid increase in height and weight, which made him look old and attractive to the boy.*
- ✓ *Underwent several changes in body shape, such as widening of the hips, enlargement off the breasts, which attracted a boy to convince her into a relationship.*
- ✓ *Development of curvy figure, due to widening of hips and thighs, making her more attractive to the boy.*
- ✓ *Her skin may have become radiant and clear, enhancing her natural beauty.*
- ✓ *Softening of the voice that could have also attracted the boy.*

- ✓ *Menstruation and ovulation, that could have resulted into release of an ovum from graafian follicles on the day she was caught with the boy.*

Behaviour changes

- ✓ Peer influence where due to strong bonds with friends and social groups that could have seduced her to join relationships.
- ✓ Mood swings due hormonal changes, that could have raised her feelings hence attracted to the boy.
- ✓ Increased independence and willingness to take risks could have also caused her into the challenges.
- ✓ Increased interest in romantic relationships and dating and desire for intimacy, all could have caused her into challenges.

(b) The events that resulted into the changes in Pamela's body from the time she was caught with a senior six boy up to when her urine tested HCG positive include;

Pamela had unprotected sex intercourse with the boy. Upon ejaculation, the released sperms into her vagina swam by aid of their tails through the fluid. The cervix relaxed and opened to allow in sperms that later continued swimming to her oviduct where fertilization of her ovulated egg from the ovary occurred. This led to formation of zygote, which underwent cell division by mitosis and was moved by the action of cilia along the oviduct to the uterus where implantation occurred, a process through which an embryo/foetus gets attached to the wall of the uterus by the placenta through the umbilical cord. The placenta then secretes human chorionic Gonadotrophin (HCG) which prolongs the activity of the corpus luteum. Due to the hormonal changes that occurred in Joan's body, they caused many body changes such as vomiting, nausea and body fatigue. After production of HCG by placenta into bloodstream, the hormone circulates in blood and when reaches the kidneys, its filtered and excreted in urine, testing HCG positive.

(c) The possible challenges that the two people are likely to face include:

- ✓ *School dropout, hence reduced educational attainment limiting future opportunities.*
- ✓ *Social stigma and discrimination, hence leading to isolation and rejection.*
- ✓ *Emotional distress. Early pregnancy leads to anxiety, depression to both girl and boys.*
- ✓ *Financial dependence, since they lack money hence depends on other people for financial support, limiting their autonomy.*
- ✓ *The girl more likely to experience complications during pregnancy and child birth.*
- ✓ *Higher risks of preterm labour, which can lead to health problems for the baby.*
- ✓ *Limited career options, due to low education levels obtained.*

I advise other youths how to prevent the above challenges include the following;

- ✓ *Abstinence from sexual intercourse*
- ✓ *Ensuring easy access to quality education, to be empowered with knowledge and skills.*
- ✓ *Use of condoms and other birth control pills to prevent contracting early pregnancy*
- ✓ *Thorough guidance and counseling*
- ✓ *Sexual education and awareness, by providing information about the risks of early marriage.*
- ✓

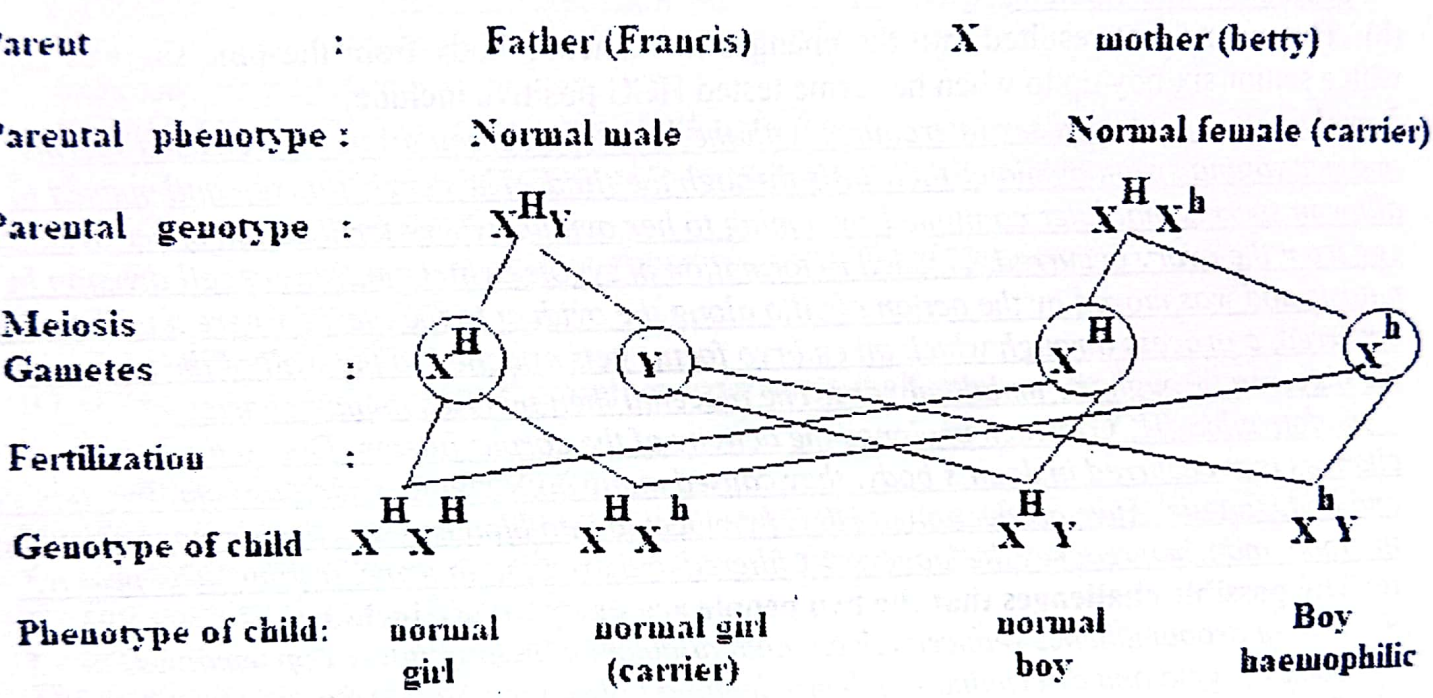
ITEM 3.5

(a) *Bleeder's disease also known as haemophilia, a sex-linked character that affects the blood's ability to clot hence blood takes too long to clot after an injury, leading to excessive bleeding, And other life threatening complications. This genetic disorder is caused by a recessive gene which is carried/ located on the X chromosome but not on Y chromosome; hence it mainly affects males than females. Males have only one X chromosome while females have two XX*

chromosomes, therefore if a sperm cell carrying Y-chromosome fuses with an ovum carrying the mutated gene for haemophilia, the resulting zygote will be male and will inherit the mutated gene for haemophilia. Since the Y-chromosome doesn't carry a functional copy of the hemophilia gene, the mutated gene on the X-chromosome will be expressed and the individual will have hemophilia. Therefore the boy will be hemophilic. However if a sperm cell carrying an X chromosome with no gene for haemophilia fuses with an ovum carrying a mutated gene, , the resulting zygote will be female and will not express hemophilia herself but will be a carrier and can pass on the mutated gene to her offspring. These genetic crosses are shown below;

Let H represent the gene for non-hemophilia normal person.

Let h represent the gene for haemophilia.



Therefore there is a the parents are both normal for hemophilia and produced an hemophilic boy, it implies that the mother is a carrier for hemophilia, hence can pass on the mutated gene to the son.

(b) The child is likely to be affected in the following ways;

- ✓ Prolonged bleeding even after a small injury, since it takes long for blood to clot.
- ✓ Delayed stunted growth: due to excessive bleeding that impairs growth and development.
- ✓ Leads to joint damage. Repeated bleeding into joints causes chronic joint pain and hence limited mobility.
- ✓ Muscle weakness, as bleeding in muscles leads to their weakness and fatigue.
- ✓ Leads to emotional distress, since excessive bleeding causes to them depression, anxiety and lowers their self-esteem.
- ✓ It increases risks of infection, due to delayed formation of a clot that prevents entry off pathogens.
- ✓ Results into chronic pain, affecting quality of life
- ✓ Limited activities done by the child, due to fear of an injury, hence they don't participate in sports and other exercises.

(c)

Since he engaged in extramarital relationships, Francis contracted human immunodeficiency virus, which leads to AIDS (Acquired Immunodeficiency Syndrome) if untreated. He might have acquired it through;

- ✓ *Sexual transmission; when he had unprotected sex with infected women and through abrasions during intercourse, HIV gains entry into his blood stream.*
- ✓ *Through sharing of sharp objects like razorblades, with infected women after use.*

Possible solutions on how to manage it.

- ✓ *Taking of medication as prescribed by healthcare provider, to suppress/lower HIV load (amount) in blood.*
- ✓ *Ensure strict adherence and taking of ARVS drugs (antiretroviral drugs); by taking the medication consistently and on time, to reduce number of virus in blood (viral load) to undetectable levels, significantly reducing the risk of transmission*
- ✓ *Regular check-ups with the healthcare to check viral load and CD4 cell count adjust medication and monitor side effect due to medication.*
- ✓ *Practice safe sex by use of condoms; to prevent transmission of sex to his wife.*
- ✓ *Use of pre-Exposure Prophylaxis (PrEP) by his wife; to reduce the risk of acquiring HIV from the husband.*

Seeking for counseling and guidance from healthcare officers by the

NB: Attempt other items.

SECTION B
SEMINAR ITEMS FOR PART 1 (ITEM 4/5)

ITEM 4.1

In June 2024, NEMA started its operation of destroying people's property found in wetlands near Kampala city. Due to the much concern by the public about NEMA's actions, the chairperson NEMA organized a TV show where he claimed that people cleared away swamps, for their settlement which has resulted into several environmental challenges impacting the central region of Uganda. Unfortunately, Peter a victim of NEMA's actions, heard only the ending statement "***I therefore urge Ugandans to sustainably use natural resources in our country***"

Task

Explain the likely effects on the environment due to people's activities in wetlands of Kampala and state how they can be overcome. Describe why NEMA decided to destroy people's property in wetlands.

ITEM 4.2

Due to increased population and intense human activities near streams and rivers, many environmental and health problems have resulted. In a research report published by Mr. Mubiru in 2023, an environmental activist, the following results were noted in his research findings in comparison with research done in 2021.

Parameter examined	Number in 2022	Number in 2023
Fish caught per year (tones)	2 million	500,000
Number of Deaths due to malaria and cholera	503 people	4,235 people
People with respiratory infections.	1500	7000
Number of industries near the water bodies	15	36