ST. JOSEPH'S S. S. S. NAGGALAMA O' LEVEL BIOLOGY SEMINAR HELD ON SATURDAY 31st MAY, 2025.

SOLUTIONS TO 553/1 THEORY ITEMS.

ITEM 1.

a) ***Explanation for observations during the rainy season.***

- During the flooding, there was leaching of mineral salts like magnesium and nitrates making them unavailable for absorption. This caused chlorosis and reduced photosynthesis.
- The lack of plant nutrients like nitrates and calcium caused failure of proper cell wall formation resulting in plants with weak stems.
- Excess water in soil displaced soil oxygen causing limited aerobic respiration and less energy. The plants could not actively absorb sufficient mineral salts further causing chlorosis and reducing plant growth.
- Lack of soil oxygen led to death and rotting of plant roots since they lacked energy to carry out vital life processes.

b) ***How the potato plants managed to produce potatoes.***

- ❖ This occurred due to mitosis, surface area for absorption of sunlight and photosynthesis increased food production that was used for growth and production of Irish potatoes.
- ❖ Because production of more roots increased surface area for absorption of more water, cells became turgid straightening the stem.
- ❖ Leaves became more exposed to sunlight so much sunlight was absorbed that increased photosynthesis to produce more food for growth and formation of Irish potatoes.

ITEM 2.

a) ***How the hailstorm led to no harvest in beans.***

- Flowers structures like anthers, stigma and others where damaged which prevented successful transfer of pollination, fertilisation and fruit formation.
- Leaves were broken, which reduced surface area for light absorption by chlorophyll hence limited photosynthesis rand growth resulted in no yields.
- Broken leaves provided a small surface area for diffusion of CO_2 through the few remaining stomata hence limited photosynthesis and no yields.
- Breaking of stems destroyed vascular bundles which prevented translocation of food, water and mineral salts thereby preventing photosynthesis and growth.

b) ***How the banana plantation was restored***.

- Banana plants developed an extensive root system with more root hairs which increased surface area enabling absorption of water that were used to carry out more photosynthesis, produced enough food leading to high growth rate.
- Formation of more root hairs enabled active absorption of more mineral salts like nitrates used to form more proteins which enabled growth of new plant tissues to replace damaged ones.
- Banana plants had underground lateral buds which underwent mitotic cell division and specialisation which enabled asexual formation of new suckers.
- The broad leaves increased surface area for more light and CO_2 absorption by chlorophyll and stomata respectively. This enabled a high photosynthetic rate forming more food used during plant growth.
- The upright stems provided best positions for optimal light absorption which led to high rate of photosynthesis providing food for growth.

ITEM 3.

a) Challenges faced by bean seeds.

Dry spell caused water shortage in the soil that limited osmotic water absorption by root hair cells. This also limited active absorption of mineral salts by root hair cells since water is a medium for water movement. Deficiency of nitrogen and magnesium in soil limited synthesis of chlorophyll by leaves hence less light was absorbed resulting in a low photosynthetic rate. Wilting of the plants caused folding/drooping of leaves and closing of stomata hence limited CO_2 absorption resulting to limited photosynthesis. The drooping leaves also provide a smaller surface area for light absorption further limiting photosynthetic rate, causing less food and stunted growth.

b) Internal processes that took place in the bean plants.

The visiting bees transferred pollen grains from the anthers to the stigma of flowers that caused pollination. On the stigma, pollen grains absorbed nutrients and germinated to form pollen tube(s) that grew to the embryo sac via micropyle. Before pollen tube entered embryo sac, generative nucleus divided into 2 male nuclei. Upon penetration into through wall of embryo sac, the tip of pollen tube burst, and the 2 male nuclei entered the embryo sac. One fertilized the egg cell to form diploid zygote that formed seed embryo, the second male nucleus fused with the polar nuclei to form triploid primary endosperm that form seed endosperm. Other nuclei degenerated. Ovules formed seeds and ovaries produced fruits to give yield.

c) How the beans overcame the challenges.

- The drooping of leaves reduced surface area exposed leading to reduced water loss and improving water conservation.
- Hairs on bean leaves trapped moist air around the leaf surface reducing concentration gradient between inside and outside of leaf hence minimising transpiration
- Developed more roots with more root hairs which increased surface area for osmotic absorption of water from the soil.
- Increased root hairs also enabled increased absorption of mineral salts like magnesium that was used by plants to synthesise more chlorophyll hence more light was absorbed enabling more photosynthesis.
- The beans developed brightly coloured flowers that attracted bees which carried out pollination hence enabling fertilisation and fruit formation.

ITEM 4.

a) ***Identify the health conditions present in Mary***.

Frequent urination and feeling hungry often, especially after eating sweet things:

Condition1: **Diabetes mellitus;** occurs when the body cannot properly regulate blood sugar levels due to insufficient insulin production; or insulin resistance; Mary's frequent urination is due to excess glucose in the blood, much glucose is filtered out of blood in glomerulus, some glucose is not re-reabsorbed by the proximal convoluted tubule. The glucose increases concentration of glomerular filtrate and limits reabsorption of water by osmosis since there is no concentration gradient between renal filtrate and blood is similar/very small. Her hunger, especially after eating sweet things, results from the body's inability to use glucose for energy due to lack of insulin, causing her cells to starve even after eating.

Eye strain while copying work when seated near the chalkboard:

Condition: long sightedness (hypermetropia). Caused by a short eyeball where divergent rays from nearby objects are poorly focused at a point behind the retina. The resulting images from the nearby chalkboard thus appear blurry.

b) ***How the parents can manage the health conditions***.

Managing Diabetes Mellitus:

Regular insulin injections to regulate her blood sugar levels by stimulating liver and muscle cells to convert excess glucose to glycogen for storage, increased respiration of glucose and increased conversion of glucose to fats in fat cells.

Reduce her intake of sugary foods and drinks. Focus on a diet with less carbohydrate and lipids such as vegetables, and lean meat to stabilize blood sugar.

Regular exercise to improve insulin sensitivity and respire excess sugars in respiration.

Managing Myopia:

Wearing glasses with convex lenses that converge light rays from beyond the eyeball to the retina.

Item 5

a)

(i) Effects of Anna's new lifestyle on her life.

Marijuana use impairs nervous coordination, response to stimuli, and memory, this explains her weak legs and inability to run effectively when faced with the dog. Long-term use may result in serious brain damage which causes impaired respiratory coordination, addiction, and reduced cognitive function.

It may cause anxiety (worrying, fear or nervousness), paranoia (irrational and harmful thoughts), or depression, especially in teenagers whose brains are still developing. This worsened her reaction to stressful situations, like encountering the dog.

Associating with a peer group that engages in risky behaviours may lead to poor decision-making, reduced academic performance, and strained family relationships.

Staying out late disrupts her sleep cycle, leading to fatigue, reduced concentration, and weakened health. This contributed to her physical weakness during the dog encounter.

Being out late in trading centres increases her exposure to dangers, such as the fierce dog, accidents, or unsafe situations like rape.

(ii) ***How her body coordinated to bring about her reaction.***

Light rays from the dog were refracted onto the retina which transduced the stimulus into impulses that were carried to the brain by sensory nerves. Anna's brain interpreted it as dangerous, signalling the hypothalamus to send impulses to the adrenal gland through a motor nerve. This stimulated the adrenal glands releasing more adrenaline which stimulated increased heart rate, pumping more oxygenated blood to her muscles while breathing rate increased to supply more oxygen to her muscles. These changes led to rapid respiration which releases much energy through respiration. Adrenaline dilated her pupils causing increased light perception and alertness.

b) How Anna can avoid her challenges.

Educate Anna about the risks of marijuana, especially as a teenager, including its effects on her brain, coordination, and mental health.

Encourage her to seek and join new friends who spend time in productive activities like studying, games and sports which can improve her wellbeing.

Advise Anna to avoid late-night outings and establish a regular sleep schedule to have about 7-9 hours of sleep per night to improve her physical and mental health.

Suggest safer, daytime activities like watching movies earlier or engaging in hobbies that don't compromise her sleeping time.

Encourage Anna to talk to a trusted adult like a parent, teacher, or counsellor who can help her manage peer pressure and make better life choices.

ITEM 6.

a)

(i) Effects of the grandmother's health condition.

Condition: Osteoporosis.

Effects:

Grandmother suffers from osteoporosis a condition caused by reduced oestrogen release causing less calcium to be stored. This makes the bones thin, weak, brittle and easily fracture under little stress as seen in the grandmother. Fractures, like the one in her leg, cause pain, limit mobility and make it hard to walk and perform daily tasks. Osteoporosis can slow the healing process of fractures due to poor bone quality, hence leading to longer recovery times.

(ii) How her reaction after lifting the hot saucepan came about.

The heat from the saucepan stimulated pain and temperature receptors in her skin which transduced the stimulus into impulses conducted to the spinal cord by sensory neurons for processing and interpretation. From sensory through relay to motor neurons, impulses crossed via synapses and were transmitted to biceps muscles by motor neurons. The biceps were stimulated, contracted and the hand was quickly withdrawn from the hot object preventing further injury.

b) How the grandmother can manage and improve the identified condition.

- Medications with mineral supplements eg calcium/vitamin D supplements to improve bone density.
- Increase calcium intake through foods like milk, yogurt, cheese, and leafy greens to support bone re-formation.
- Engage in simple physical exercise (e.g., walking or light strength training) as recommended by her doctor to strengthen bones and improve balance, reducing the risk of future falls.

ITEM 7.

a) Menstruation is a periodic cycle that begins at puberty and ends at menopause. At puberty, GnRH stimulates the anterior pituitary to synthesise and release more FSH and LH into blood, they travel and bind to ovaries where they cause changes in preparation for pregnancy. FSH stimulates growth and maturation of ovarian follicles into Graafian follicles. FSH also stimulates release of more oestrogen from ovary into blood stream. Increased oestrogen causes a surge of LH from the which causes ovulation and development of corpus luteum that releases more progesterone. Progesterone leads to thickening of uterine in preparation for implantation. If fertilization does not occur, the corpus luteum degenerates, progesterone levels drop significantly causing the lining of the uterus to break down to release blood hence menstruation and the cycle is repeated. The high oestrogen levels enable repair of the uterine wall.

b) ***Advice to overcome challenges***.

- ❖ Abstinence to prevent contraction of STIs and early pregnancies that arise from unprotected sexual intercourse.
- ❖ Attending guidance and counselling camps to get more information about teenage pregnancy and preventive measures of HIV and teenage pregnancy.
- ❖ Girls avoiding moving at night and alone to prevent risks of rape and contraction of STIs and HIV.
- ❖ Through sex education to create awareness among adolescents about reproductive health, including how pregnancy occurs and the risks of STIs.
- ❖ Avoiding alcohol and drugs so that they remain mentally alert which prevents high risks of sex harassment.
- ❖ Avoiding bad peer groups that can lure them into unsafe sexual activities.

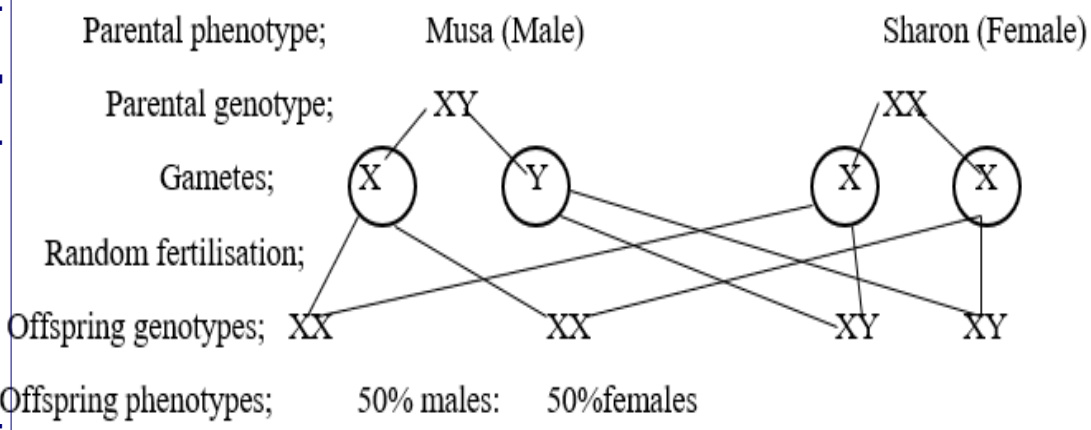
ITEM 8.

a) ***How the condition in the fourth child came about.***

Both parents are heterozygous with an allele for normal and abnormal skin, hair and eye colour.

Let allele for albinism be a.

Let allele for normal skin, hair and eye colour be A.



From the above cross, the condition came about when the child inherited the homozygous recessive aa genotype that led to albinism.

b)

(i) How the couple can live positively.

- Eating a diet rich in vitamins and proteins to improve immunity and carbohydrates for respiration to get energy.
- Getting HIV medication such as ARVs and taking them as prescribed to suppress the virus.
- Going for guidance and counselling from medical personnel and counsellors to minimise emotional distress that comes with living with HIV.
- Develop strong support from other HIV positive individuals, community and staying faithful to each other which offers emotional support.

(ii) How the couple can take care of their fourth child.

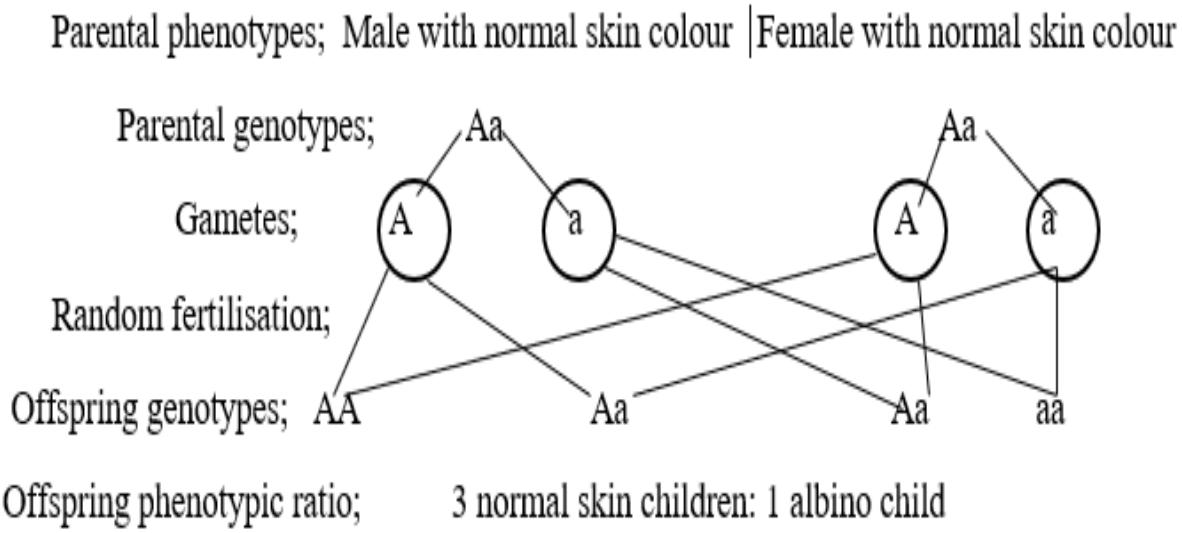
- The mother should take ARVs during the breastfeeding period to reduce viral load and minimise risk of child infection.
- In case of infection to the child, the child should be immediately started on ARVs to prevent infection.
- The child can be fed on well prepared food formulae containing all food values to reduce risk of infection through breastfeeding.
- Feeding the baby on pasteurised human milk that is safe from HIV.
- The parents should provide materials like cosmetics, shades and caps to protect the child from strong sun radiations.
- The child should receive guidance and counselling to reduce the feeling of stigma from the community.

ITEM 9.

(a)

i) Why Sharon should not lose hope of having a boy.

Sex is determined by chromosomes X and Y.
Sperms have either X or Y chromosomes while eggs have only X chromosomes.
Therefore, sex is determined by the type of sex chromosome in the sperm that fertilises the egg as shown below:



From the above cross, there is a 50 % chance for Sharon to have a boy in her next pregnancy.

ii) Consequences of Sharon's decision.

- Under nutrition of iron and carbohydrates will lead to anaemia and gestational diabetes that can cause an under-weight baby.
- Under nutrition of proteins and vitamins will lead to weak immunity which can cause increased infection to mother and foetus.
- Lack of antenatal care may cause defects in the child since complications are not identified or treated early.

- Without antenatal care, she will not get needed guidance and counselling, and this may cause stress related pregnancy complications.

Without antenatal care, she may not accurately track her delivery date which can lead to unsafe delivery out of the hospital.

Abortion may cause her excessive bleeding and internal clots that can result to death

Abortion may damage her uterus leading to reduced fertility.

Abortion may cause her social stigma since it is against accepted social and cultural practices.

b) How the couple can stay healthy and have a safe delivery.

- Sharon should eat a diet rich in proteins for proper growth of the foetus, carbohydrates to obtain energy, vitamins to improve body functioning, iron for formation of red blood cells.
- Musa and Sharon should receive counselling to accept the pregnancy and support each other through.
- Sharon should go for planned antenatal visits to receive education on care for pregnancy and preparation for a safe delivery.
- Sharon should be sensitised on the dangers of abortion to her body.

ITEM 10.

a) How the highlighted activities on the landing site affect the environment.

Untreated effluents cause eutrophication which leads to excessive growth of phytoplankton like algae. This blocks light penetration underneath resulting in reduced visibility to aquatic organisms and limited photosynthesis at the bottom.

Also, the excess phytoplankton die at a high rate and their decomposition by aerobic bacteria consumes a lot of dissolved oxygen causing oxygen depletion, suffocation and death of aerobic organisms and a bad smell.

Lack of latrines leads to defecation in open areas like bushes and the lake which increases risk of water borne disease like cholera, typhoid and dysentery that can cause death especially to children.

Defecation in unsafe places like bushes and nearby forests increases risk of sexual violence like rape to women and young girls in this community.

Indiscriminate fish nets capture young fish and unintended organisms which greatly reduces their population, disrupts feeding relationships and causes death and migration. This reduces food and income in the community.

During construction of residential houses, reclamation of parts of the lake and clearing of nearby forests results in destruction of habitats and breeding grounds which reduces population sizes and biodiversity in the area.

b) (i) ***Possible solutions to the problems.***

Effluents should be treated before release to reduce on degree of eutrophication and general pollution of the lake.
Leaders should mobilise for construction of latrines in the community to ensure proper disposal of human wastes which promotes sanitation and safe water in the community.
Water police should be set up to patrol and arrest fishermen using unacceptable fishing nets and a big penalty to the offenders.
Community or district engineers should only approve plans that do not encroach on existing natural vegetation.

(ii) ***Importance of conservation.***

- The freshwater body provides habitats and breeding grounds for animals which provides a rich source of proteins to the community.
- Water bodies are important carbon sinks that absorb a lot of carbon dioxide hence minimise greenhouse effect and global warming.
- Conserving the lake will maintain a beautiful scenery that provides recreation activities like swimming, boating, fishing. This boosts tourism and the local economy.
- Conservation of the lake provides clean water for human and animal consumption.
- Fishing activities on lakes are important economic activities which bring in money that is used to fund community development.

ITEM 11.

a) Dangers of Mukasa's practices.

Clearing the forest reduces average rainfall in the area hence less soil water resulting in limited photosynthesis and stunted plant growth. This leads to less food in the community.
Clearing forests leaves soil exposed and reduces binding of soil by roots. This increases risk of erosion top fertile soil.
Clearing forests destroys a wide range of habitats and breeding grounds for a lot of organisms which increases risk of species endangering and extinction.
Reduced vegetation cover reduces carbon sinks which leads to accumulation of CO_2 and more heat is trapped in the lower atmosphere causing temperature rise.
Monocropping leads to continued removal of the same nutrients for long resulting to depletion of nutrients required by the maize hence stunted growth and poor yields.
Continued herbicide use kills plants that are important source of food and this leads to starvation and death of animals which reduces biodiversity.

- Herbicides can kill non-target organisms in soil which reduces nutrient recycling resulting in loss of soil fertility.
- Artificial fertilisers cause rapid growth of unintended plants which rapidly utilise soil nutrients causing their depletion.

- Artificial fertilisers are usually in high concentrations that are toxic to soil organisms leading to death which again reduces nutrient recycling resulting in loss of soil fertility.
Artificial fertilisers are readily washed to water bodies causing eutrophication which can result to rapid growth of algal blooms.
Burning plant remains increases temperature and kills soil organisms
Burning plant remains reduces humas content in the soil.
Burning of plant remains releases smoke with carbon monoxide that cause suffocation and death of aerobic organisms.
Ploughing using heavy tractors compacts soil particles which reduces drainage and aeration limiting activities of soil organisms.

b) ***Sustainable environment utilisation of the environment***.

- Planting perennial tree crops like mangoes which provide food and mediate climate for a long time.
- Use of organic fertilisers that slowly release nutrients for a long time.
- Intercropping with legumes which fix nitrogen through their symbiotic relationship with nitrogen fixing bacteria.
- Intercropping with cover crops which minimise soil erosion
- Practicing minimum tillage by using mulches to minimise weed growth and maintain soil structure.
- Using plant healthy remains as mulches which improves nutrient recycling and maintains soil fertility.
- Practice crop rotation with legumes which ensure continued addition of nitrates.
- Bush fallowing to allow nutrient restoration through sustained nutrient cycles.

ITEM 12.

a) How farmers' activities resulted to the challenges.

Brick laying leaves large holes that modify the natural landscape and interfere with water drainage channels. This increases risk of flooding during heavy rains.
Cutting down of trees leads to increase in CO_2, a greenhouse gas which modifies climate through the greenhouse effect.
Cutting down trees exposes the land to running water and weakens attachment between soil particles hence large masses of soil are easily moved during heavy rains causing mudslides.
Digging up and down on hills weakens soil attachment between soil particles and disturbs soil structure and this increases risk of large masses of soil being carried away.
Large herds of cattle exert a lot of force and weaken soil structure making large masses of soil more likely to be carried away.

b) Benefits of conserving the hills.

- The hill provides habitats and breeding grounds for plants and animals which maintains high biodiversity and provides a source of food and medicine to the community.
- Conserving the hill maintains soil structure and fertility. This enables high crop yield, provides nutrients needed for a balanced diet and leads to a healthy and productive society.
- Conservation of hills through contour ploughing and terracing minimises soil erosion, improves water retention and minimises disasters like mudslides and flooding.
- Conservation through keeping forest cover increases CO_2 absorption from environment and maintains humidity through transpiration. These benefits protect the environment by minimising rate of climate change.
- Conserving the hill will maintain high biodiversity and a beautiful scenery that attracts tourists which is a source of income to fund community development.

ITEM 13.

a) How car dealers contribute to environmental issues in the scenario.

Increased greenhouse gases cause higher greenhouse effect with high temperatures that result in death of plants and other organisms.

The old cars release a lot of acidic gases like CO2 and NO2 which result in acid rain that corrodes or damages leaf surfaces resulting in reduced photosynthesis which limits food in the community.

Smoke contains unburnt carbon particles that reduces visibility in air and can result in accidents to birds and motor vehicles.

The greenhouse gases trap extra heat which causes climate change leading to conditions like melting of ice caps, flooding and high temperatures unfavourable for plant growth.

Increase in greenhouse gases results in ozone depletion which causes penetrating of UV radiation increasing risk of skin cancer.

b) Environment friendly alternatives to dependence on fossil fuels.

- Importation of brand-new vehicles with advanced technology like catalytic converters to convert environmentally harmful gases to less harmful products.
- Importing cars that use clean energy such as electricity and ethanol which do not increase harmful gases in the environment.
- Embrace use of public transport which carries many people at once hence reducing consumption of fossil fuels therefore less pollution.
- Embrace use of bicycles and walking to minimise fossil fuel consumption and improve physical health.

ITEM 14.

(a)(ii)

- Muscle pain and fatigue

Due to intense activity, the demand for oxygen in muscles exceeded supply.
His muscles switched from aerobic to anaerobic respiration, producing lactic acid.
Lactic acid build-up led to muscle pain and fatigue.

- **Rapid Breathing**

To meet the high oxygen demand, his breathing rate increased.
This is the body's way of trying to **supply more oxygen** and **remove excess carbon dioxide**.

- Feeling Hot.

During exercise, muscles generate a lot of heat as a by-product of energy production.
The body temperature rose, causing him to feel hot.

b)

- His rapid breathing continued to supply extra oxygen. Lactic acid diffused from muscle cells in to blood and carried to liver cells were its brokenk down into carbon dioxide, water and more energy, relieving muscle pain.
- Cooling of body
  Sweating to enable heat loss by evaporation and vasodilation of blood vessels near the skin thus more heat was dispatched to environment
- Energy Replenishment
  The glass of juice he took helped restore glucose levels, providing fresh energy. This helped his muscles recover and made him feel strong enough to go home.

ITEM 15.

a):

1. Breathing Difficulties
This reduced the amount of oxygen reaching the body's cells, leading to fatigue and poor organ function.
2. High Body Temperature (Fever)
It increases the metabolic rate, causing dehydration and weakness, especially in a child.
3. Vomiting
Led to loss of fluids and nutrients, which can result in dehydration
4. Mouth Sores
Made it painful to eat, reducing food intake and worsening malnutrition.
5. Anaemia
Means the baby had low red blood cell levels or low hemoglobin. This reduced the oxygen-carrying capacity of the blood, causing tiredness, weakness, and slowed recovery.

(b)

Eating Iron-rich foods to treat anemia e.g. mashed beans, lentils, liver, minced meat, and green leafy vegetables (like spinach). Iron is essential for producing red blood cells and increasing hemoglobin levels.

Eating protein-rich foods in order to enable cell repair and growth such as eggs, milk, yogurt, soft fish, chicken, and groundnuts (peanut paste) Proteins help in body tissue repair.

Eating vitamin C-rich foods to boost the immune system and fight infection such as oranges, mangoes, tomatoes, pawpaw, and guavas.

Eating energy-giving foods to replace lost energy such as porridge, rice, potatoes, bananas, maize meal, and bread. These foods provide energy needed for recovery and daily activity.

Drinking more boiled and clean water, soups, oral rehydration solution (ORS), and fresh juice in order to replace lost fluids due to fever and vomiting, and prevent dehydration.

ITEM 16.

(a)Sitting Long Hours

Reduces calorie burning and contributes to weight gain, increasing the risk of cardiovascular diseases (e.g., high blood pressure, heart disease).

Increases risk of blood clots, which may affect circulation and oxygen delivery.

Leads to poor blood circulation, especially in the legs, causing swollen feet (oedema).

Smoking

Damages the lungs, leading to coughing and coughing up blood due to chronic bronchitis or early signs of lung disease.

Destroys alveoli, the air sacs where oxygen exchange happens, reducing oxygen loading by red blood cells.

Narrows and hardens blood vessels, increasing risk of heart disease and stroke.

Eating Fatty Foods

High intake of saturated fats and cholesterol leads to plaque build-up in arteries (atherosclerosis).

Increases risk of heart attacks, high blood pressure, and cardiovascular disease.

Contributes to obesity, which burdens the heart and worsens circulation.

(b)

Stop smoking so as improve lung function and oxygen intake, reduce coughing and risk of lung disease and lower the chance of heart attacks and strokes

Adopt a Balanced, heart-healthy diet such as fruits and vegetables, lean proteins like fish, beans, and chicken and Low-fat foods.

Start regular physical activity. This improves heart function, circulation, and oxygen delivery.

Regular medical check-ups so as to monitor blood pressure, cholesterol levels, and heart health regularly.

Avoid or reduce alcohol, which can worsen heart conditions.

SOLUTIONS TO 553/2 PRACTICAL ITEMS.

ITEM 1

(a) Aim, hypothesis, variables, apparatus/requirements

Aim of the experiment:

An experiment/investigation to determine the water retention abilities of soil samples L and M so as to explain the difference in the yields from the two parts of Rashid's garden.

Or

An experiment/investigation to determine the water retention abilities of soil samples L and M so as to determine which part of the garden they were obtained.

Hypothesis:

Soil sample L was obtained from Northern part while sample M from the southern part.

Or

Soil sample M was obtained from Northern part while sample L from the southern part.

Variables in the experiment:

Independent variables: Soil samples L and M

Dependent variables: Volume of water retained

Controlled variables: Volume of water used, Volume of soil used

List of materials:

- Measuring cylinders
- Filter funnel
- Cotton wool
- Water
- Soil samples L and M

Procedure of the experiment:

1. A small piece of cotton wool was inserted into a funnel, the funnel was then placed on the mouth of a measuring cylinder.
2. Using another measuring cylinder, 30 cm^3 of soil sample L was measured and poured into the filter funnel.
3. Using another measuring cylinder, 50 cm^3 of water was measured and poured into the soil in the funnel.
4. The experiment was left to stand until the last drop of water came out of the funnel.
5. The volume of water collected in the measuring cylinder was recorded.
6. The procedure 1 to 5 was repeated with soil sample M.

Results

Soil sample	L	M
Volume of water used (cm^3)	50	50
Volume of water collected (cm^3)	38	30
Volume of water retained (cm^3)	12	20

(b) Soil sample M was obtained from the northern part while L from the southern.

(c) The soil in the northern part of the garden retains much water, the roots are short because enough water is available for absorption. The leaves are big to increase the rate of transpiration to lose excess water. The plants in the northern garden have enough water which is a raw material for photosynthesis and large leaves which trap enough sunlight for photosynthesis hence the plants make enough food leading to high yields. The soil in the southern part of the garden retains little water, they have many long roots so as to absorb water from deep in the soil. The leaves are

small to reduce of the rate of transpiration. The plants in the southern part of garden lack enough water which is a raw material for photosynthesis and the leaves are small reducing on the surface area for trapping sunlight hence the plants make little food leading to low yields.

ITEM 2

(a) (i) Phylum Arthropoda

Reasons: they both have an exoskeleton, they both have jointed appendages.

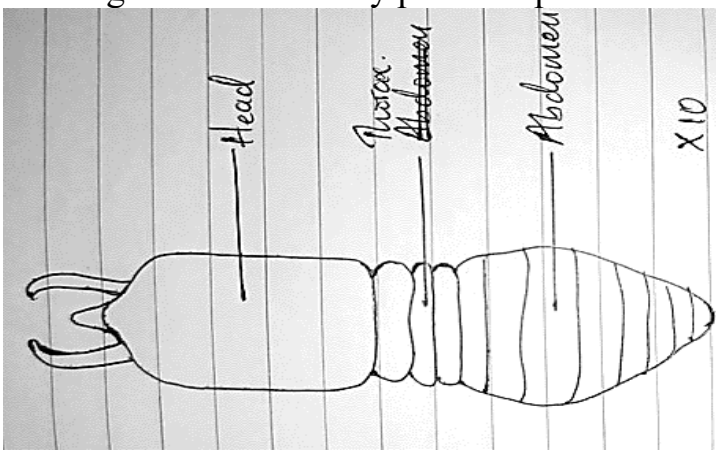
Kingdom Animalia

Reasons: they both have structures for locomotion, they have mouth parts.

(ii) It has sharp claws which it uses for firm attachment onto the skin of the cow.

- It has a hard body cuticle for protection
- It is dull colored for camouflage
- It has sharp mouth parts for sucking blood from the cow.

(b) A drawing of the main body parts of specimen B



ITEM 3

(a) Aim of the experiment

An experiment to determine the nutrient compositions of food solutions R and S so as to explain to Hamza why he did not win the competition.

Hypothesis

Food sample S lacks proteins and vitamin C which are present in sample R.

Variables in the experiment

Independent variables: Food sample R and S, Test reagents.

Dependent variables: Colour changes

Controlled variables: Volume of food solution, volume of reagents

Procedure of the experiment

Test	Sample	Observation	Deduction
1 cm^3 of food sample was placed in a test tube and 3 drops of iodine added.	R	Solution turned to black (blue-black) colour	Starch present
	S	Solution turned to blue colour	Starch present

To 1 cm^3 of sample in a test tube, 1 cm^3 of Benedict's solution was added and then boiled.	R	Solution turned to yellow colour	Reducing sugars present
	S	Solution turned to green colour	Reducing sugars present
To 1 cm^3 of sample in a test tube, 1 cm^3 of sodium hydroxide solution was added followed by 3 drops of copper (II) sulphate	R	Solution turned to purple colour	Proteins present
	S	Solution turned to blue colour	Proteins absent
To 1 cm^3 of DCPIP in a test tube, food sample was added drop by drop until in excess.	R	The DCPIP solution was decolourised	Vitamin C present
	S	The DCPIP solution remained blue	Vitamin C absent

(c) Fred's diet contained proteins and vitamin C which are lacking in Hamza's diet. Proteins helped to build muscles in Fred's body during training and vitamin C provided a strong immunity ensuring that he did not fall sick during the three months training. Hamza on the other hand lacked proteins therefore his muscles were not well built and could have fallen ill during the training period due to weak immunity. Hamza could not win Fred in the competition.

ITEM 4

(a) (i) They are fruits;

Features:

- They have two scars
- They have a pericarp

(ii) Specimen X

Reasons:

- It has hairs for sticking on to the body hence being moved to Shakirah's garden.
- It has many segments which increase their multiplication speed.
- It is light so that it can easily be carried from one place to another.

(b) A drawing of specimen X