JJEB PROPOSED RESPONSES BY JBA JACOB

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SECTION A

Answer all the items in this section.

Item 1

During the recent dry spell, Jane observed that most of the short herbal plants in their garden had few leaves, matured early, produced few flowers and small sized mature fruits containing seeds which fell off before the plants could dry and die, leaving the garden bare. The paspalum in the nearby school disappeared leaving the compound bare. The large trees lost their leaves and flowers and some of their branches and roots dried. However, the green paspalum and the short herbal plants were later observed growing in the school compound and garden respectively and the large trees produced new new leaves upon receiving rains.

Task

a) Identify the processes that were affected in the large trees.

- ***Photosynthesis***
- ***Transpiration***
- ***Respiration***
- ***Absorption of water and mineral salts***
- ***Growth***
- ***Reproduction.***

b) Explain how the normal functioning of the large trees were affected by the dry spell.

- ***The dry soil contained very little water, so roots could not absorb enough to keep cells turgid, causing leaves and branches to wilt and some roots to dry.***
- ***With little water, mineral salts could not dissolve and reach the roots, leading to nutrient deficiency that limited leaf and flower development.***
- ***Shortage of water caused stomata to close, reducing transpiration and slowing the movement of water and minerals within the plant, contributing to drying of branches.***
- ***Closed stomata prevented carbon dioxide from entering the leaves, and lack of water reduced photosynthesis, lowering glucose production needed for growth, repair, and formation of fruits and seeds.***
- ***Lack of water and mineral nutrients prevented cells from dividing and expanding properly, because water keeps cells turgid and nutrients provide materials for new cells, causing stunted growth, shedding of leaves and flowers, and early fruit drop, which disrupted reproduction.***

c) How were the different plants able to survive?

- ***Short herbal plants survived through drought-resistant seeds that remained dormant until rains returned.***
- ***Large trees shed leaves and some branches to reduce surface area for water loss and relied on stored water and nutrients.***

- ***Paspalum survived by maintaining living tissues below ground, which allowed it to regrow quickly when water became available.***
- ***Large trees produced new leaves when rains returned, resuming growth and photosynthesis.***

Item 2

John was persuaded to start smoking marijuana with his friends in the nearby trading centre, which he is now addicted to. One day, during a police hunt, he accidentally stepped on a sharp thorn as he was running away and immediately limped before he could stop to remove it. Although he successfully removed the thorn from his foot, the wound could not easily heal due to a health condition brought about by insufficient insulin hormone production. He has also developed a heavy cough and chest pain due to his addiction.

Task

(a) Explain how John's reaction came about as he was running away.

- ***The pain receptors in John's skin of the foot detected the pain stimulus from the thorn and converted it into nerve impulses.***
- ***The impulses were transmitted through the sensory neuron to the spinal cord for interpretation; where the impulses crossed a synapse and were received by the relay neuron in the spinal cord.***
- ***The impulses travelled through the relay neuron, crossed a synapse and were received by the motor neuron; which transmitted them to leg muscles stimulating them to contract and relax, enabling John to limp, and then remove the thorn from his foot or withdraw the foot from the thorn.***

(b) How can John manage his health conditions to live a better life?

- ***The condition caused by failure of the pancreas to secrete enough insulin is diabetes mellitus.***

Managing diabetes mellitus

- ***Take insulin injections to lower blood glucose levels.***
- ***Follow a controlled diet by reducing simple carbohydrates and eating balanced meals to maintain stable blood sugar levels.***
- ***Do regular exercise to improve muscle glucose uptake and enhance insulin action.***
- ***Avoid alcohol and toxins to protect the pancreas and liver and support normal glucose regulation.***

Managing smoking and addiction

- ***Stop smoking marijuana completely, to prevent further lung, brain and heart damage.***
- ***Avoid bad peer groups, to reduce the temptation and pressure to smoke again.***
- ***Do regular physical exercise, to improve lung function and overall body fitness.***
- ***Eat a healthy, balanced diet, to strengthen immunity and support body repair.***
- ***Seek guidance and counseling, to get professional help in overcoming addiction and making better choices.***
- ***Visit a nearby health unit such as a hospital for check-up to monitor the extent of organ damage and receive appropriate treatment.***

Item 3

Sarah who was only fourteen years old and in S.2 was engaged in sexual intercourse with the motorcyclist who used to carry her to school. The man used to have unprotected sex with other women before they had the relationship with Sarah. After six months, Sarah started falling sick frequently, becoming weak and having skin rash as well as general body weakness which has affected her stay at school. After tests, the doctor confirmed that Sarah's illness was due to reduced immunity because of a health condition acquired as a result of her sexual behavior. Recently, Sarah's parents produced her sister who is an albino yet both of their parents have normal skin color. The family is stressed.

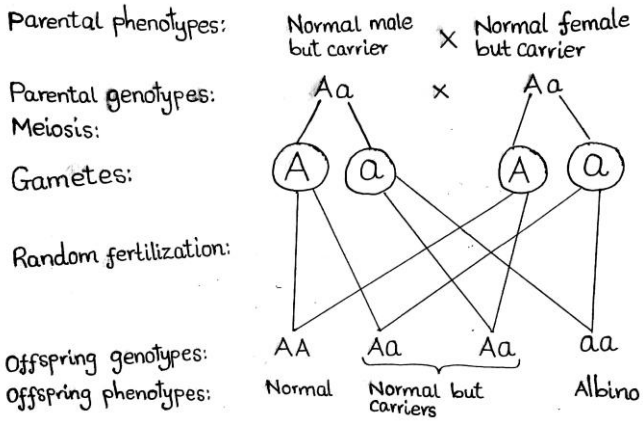
Task

a) Genetically show how the sister's condition came about.

- ***Both parents had the allele for albinism (heterozygous) though they were phenotypically normal. The albino sister inherited the an allele for albism from each parent, as shown below;***

  Let A represent an allele for normal skin

  Let a represent an allele for albinism.



- ***There was a possibility of producing 3 normal children and 1 albino; Therefore the possibility of an albino sister being produced was ¼×100=25%***

b) How can Sarah manage the challenges associated with her health condition to live longer?

- ***Take antiretroviral therapy (ART) consistently to control the virus and protect immunity.***
- ***Eat a balanced and nutritious diet to provide essential nutrients that help strengthen the immune system.***
- ***Go for regular medical check-ups to monitor health, viral load, and detect infections early.***
- ***Exercise moderately to improve body strength and support immune function.***
- ***Avoid risky behaviours like unprotected sex and sharing sharp objects to prevent new infections.***
- ***Seek psychosocial support and counseling to help him cope emotionally and reduce stress.***
- ***Maintain good personal hygiene to prevent opportunistic infections.***

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- ***Get enough rest and manage stress to keep immunity strong.***
- ***Avoid smoking and excessive alcohol to prevent further weakening of the immune system.***

SECTION B

Answer two items from this section

PART I

Answer only one item from this part.

Item 4

A certain swamp had thick vegetation before Isaac cleared a big part of it to grow only rice on a large scale. He puts poison in the garden to kill rats and other pests, apply artificial fertilizers to make the soil fertile and dig large water channels to direct water away from their farms. After several seasons, challenges have come up such as rapid growth of new kinds of weeds in the swamp, invasion of their homes by monkeys, reduced catch of mudfish, and flooding is now common and reduction in crop yields.

Task

(a) Explain how Isaac's actions caused the challenges.

- ***The swamp vegetation provided habitats and food for animals such as monkeys; clearing and draining it destroyed these habitats, forcing the monkeys to invade people's homes in search of food and shelter.***
- ***The swamp served as a breeding and feeding ground for mudfish; draining it destroyed these sites and lowered water quality, leading to reduced fish populations and low catches.***
- ***Wetlands naturally absorb and store excess rainwater; draining them removed this buffering capacity, so rainwater now accumulates rapidly, causing frequent floods.***
- ***Clearing wetland vegetation exposed soil to direct sunlight and erosion, which depleted organic matter and nutrients, leading to reduced soil fertility and low agricultural yields.***
- ***The poison used to kill rats and pests was non-selective, killing beneficial soil organisms such as earthworms and decomposers that recycle nutrients and improve aeration, thereby reducing soil fertility and crop productivity.***
- ***Continuous application of artificial fertilizers altered soil pH and mineral balance, making the soil unsuitable for many native plants and promoting the growth of invasive weeds that tolerate poor conditions.***

(b) How can the challenges be overcome?

- ***Replanting and conserving wetland vegetation to restore habitats and increase water absorption.***
- ***Constructing controlled water channels while leaving sections of the swamp undrained to reduce flooding and support mudfish breeding.***
- ***Using organic manure and practicing crop rotation to improve soil fertility and sustain yields.***
- ***Applying integrated pest management such as natural predators, crop rotation and selective pesticides to control pests without harming useful organisms.***
- ***Reducing excessive use of artificial fertilizers and encouraging compost and other natural soil improvers to maintain soil pH and suppress invasive weeds.***

Item 5

During road construction project, the thick vegetation on a nearby hill was cleared in order to carry out quarrying of the rock to obtain gravel. Motorists have continued to use the road as it is being constructed and this produce a lot of dust. The residents have observed that many deep gulleys have been formed on the Hill slopes, crop yields on the road sides have reduced, wild animals are severally destroying people's crops and incidences of strong winds are now common.

Task

a) Explain the cause of the challenges being experienced by the residents.

- ***Clearing vegetation removed plant cover that held the soil together with roots, leaving the hill slopes exposed to erosion, leading to formation of deep gullies.***
- ***Loss of vegetation reduced organic matter and water-holding capacity of the soil; this made soils dry, less fertile, and unable to support high crop yields along the roadsides.***
- ***Quarrying and vegetation clearing destroyed natural habitats and food sources for wild animals, forcing them to migrate into people's gardens in search of food, where they end up destroying crops.***
- ***Vegetation previously acted as a windbreak; its removal exposed the area, increasing the frequency and intensity of strong winds.***
- ***Dust raised by moving vehicles and road construction settles on crop leaves, clogging stomata and blocking light, which reduces photosynthesis and lowers crop yields.***

b) Why was it important to keep the hill undisturbed?

- ***The vegetation would have protected the soil against erosion, preventing loss of topsoil and formation of gullies.***
- ***Roots and organic matter from plants would have maintained soil fertility and moisture, supporting healthy crop growth.***
- ***The hill vegetation provided habitats and food for wild animals, keeping them away from people's gardens.***
- ***Trees and shrubs acted as windbreaks, reducing the occurrence of strong winds.***
- ***Vegetation cover minimized dust pollution, ensuring crop leaves remained clean for normal photosynthesis.***

PART II

Answer only one item from this part.

Item 6

Joshua a good athlete decided to compete in a 10000m race when he was fasting. During the race, he felt weak and had muscle pain. He also observed several changes on his body including an increase in breathing rate, heartbeat and sweating. However, he had some energy to complete the race. After the race, he breathed deeply and rapidly and later the pain disappeared.

Task

a) Explain the challenges that Joshua faced during the race.

- ***Muscle pain: Vigorous running increased energy demand in muscles. Oxygen supply was insufficient for aerobic respiration, forcing muscles to rely on anaerobic respiration, producing lactic acid that accumulated and caused pain.***
- ***Weakness and fatigue: Fasting had depleted glycogen stores in the liver and muscles, so less glucose was available for respiration, reducing ATP production and causing fatigue.***
- ***Rapid heartbeat and increased breathing rate: To meet the high oxygen demand of muscles during running, his heart and lungs worked faster, reflecting physical strain.***
- ***Excessive sweating: High metabolic rate generated heat; sweating occurred to cool the body, leading to water and salt loss that could worsen fatigue.***

b) How was Joshua's body able to overcome the challenges experienced?

- ***Removal of lactic acid: Lactic acid diffused into the blood and was transported to the liver, where it was oxidized into carbon dioxide, water, and energy once extra oxygen was supplied through deep post-race breathing.***
- ***Energy from fats: After glycogen was depleted, stored fats were broken down and oxidized to provide energy that allowed him to finish the race.***
- ***Supportive body responses: Rapid breathing and heartbeat during the race supplied oxygen to muscles, and sweating helped regulate body temperature, preventing overheating and aiding continued muscle function.***

Item 7

Ritah decided to skip meals and takes dietary pills in an attempt to improve her body image. She usually depends on sweets but rarely brushes her teeth. She also usually stays in a company of other girls who smoke. Recently, she has become bony and started falling sick more often. She also started complaining of breathing difficulties , toothache, and was diagnosed with high blood pressure. All her conditions were attributed to her lifestyle.

Task

(a) Explain how Ritah's lifestyle caused the challenges she is experiencing recently.

- ***Weight loss: Skipping meals and relying on dietary pills deprived her body of energy and essential nutrients, leading to loss of fat and muscle mass, hence appearing bony.***
- ***Frequent illness: Lack of proteins, vitamin C, and iron weakened her immune system, reducing antibody production and lowering resistance to infections.***
- ***Difficulty in breathing: Inhaling second-hand smoke irritated and inflamed her airways, damaging the cilia and causing excess mucus production. This narrowed the air passages, reduced oxygen absorption in the alveoli, and led to difficulty in breathing.***
- ***Toothache: Frequent consumption of sweets without brushing promoted bacterial growth on teeth, producing acids that eroded enamel and caused decay.***
- ***High blood pressure: Poor diet high in sugar and low in nutrients, combined with stress, causes blood vessel constriction and changes in fluid balance, leading to increased blood pressure.***

b) What advice can you give to her to live a better life life?

- ***Eat regular, balanced meals rich in carbohydrates, proteins, fats, vitamins, and minerals to maintain energy, immunity, and healthy body weight.***
- ***Limit sugary foods and brush teeth at least twice daily to prevent tooth decay.***
- ***Avoid exposure to cigarette smoke to protect the lungs and overall respiratory health.***
- ***Engage in regular physical activity to strengthen the heart, muscles, and lungs.***
- ***Maintain a healthy body image and avoid harmful weight-loss practices like skipping meals or excessive dietary pills.***

END

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