WAKISSHA JOINT MOCK EXAMINATIONS 2025:
BIOLOGY PAPER 1 – PROPOSED MARKING GUIDE

SECTION A: COMPULSORY ITEMS

Item 1: Agriculture & Mineral Deficiency

(a) Explain the causes of the observations for each crop in the subsequent years.

The initial high yields and healthy, green leaves indicate the soil was fertile and had a sufficient supply of essential minerals like nitrogen, phosphorus, and potassium.

Over the subsequent years, continuous farming (intercropping maize and cassava) without replenishing the nutrients led to soil exhaustion.

The small, yellow leaves and stunted appearance are symptoms of a nitrogen deficiency.

Nitrogen is crucial for chlorophyll production, so a lack of it leads to chlorosis (yellowing of leaves).

The small maize cobs and grains point to a phosphorus deficiency. Phosphorus is essential for energy transfer, root development, and seed/fruit formation.

(b) Explain the low yields in the subsequent years.

Low yields are a direct result of the mineral deficiencies.

Nitrogen deficiency leads to reduced photosynthesis due to a lack of chlorophyll, which means less food is produced for the plants' growth.

Phosphorus deficiency hinders energy transfer and the formation of reproductive parts (cobs and grains), leading to poor crop quality and reduced yield.

The stunted growth from these deficiencies means the plants are unable to reach their full potential, resulting in lower overall production.

(c) Suggest to the farmer how he can improve on yields of the said crops.

The farmer can practice crop rotation with legumes for example beans, groundnuts to fix nitrogen back into the soil naturally.

Applying fertilizers, such as inorganic fertilizers NPK or organic manure, to replenish the soil with essential nutrients.

Leaving the land uncultivated for a period to allow the soil to naturally regain its fertility.

Creating a compost heap from organic waste to produce nutrient-rich soil amendments.

Item 2: Nervous System & Physiological Response

(a) Explain the roles of the body structures involved in this situation.

Eyes received the stimulus (sight of the snake) and photoreceptors in the retina converted the stimulus into nerve impulses which are transmitted by the optic nerve to the brain for interpretation.

The brain interpreted the visual information as a threat and initiates a response in terms of fear and the urge to run.

The brain's hypothalamus activated the sympathetic nervous system, and sent signals through the spinal cord to adrenal glands which influenced the release of adrenaline hormone from adrenal glands and this causes a flight response of running.

Muscles of the legs, the effectors contract rapidly and repeatedly to enable Joan to run away. This is a response to the adrenaline and signals from the sympathetic nervous system.

(b) Explain the physiological changes in her body leading to the heavy breathing and feeling of pain in her legs.

The stress caused by seeing the snake triggered the sympathetic nervous system which prepares the body to stressful or dangerous situations

The adrenal glands released adrenaline into the bloodstream.

Heavy Breathing, adrenaline increased her breathing rate to take in more oxygen. The increased oxygen supply was needed for aerobic respiration to generate the large amount of energy (ATP) required for the muscles to contract rapidly and enable her to run.

Pain in Legs, during the intense run, her muscles needed more energy than could be produced aerobically. The muscles switched to anaerobic respiration, which produces energy without oxygen but also generates lactic acid. The buildup of lactic acid in the muscle tissues causes pain, cramps, and fatigue.

(b) Suggest how Joan was able to recover from her conditions with time.

Her heavy breathing continued for a while after she stopped running to repay the oxygen debt. This extra oxygen was used to break down the accumulated lactic acid in her muscles into carbon dioxide and water.

Over time, her body metabolized the excess adrenaline, and her heart and breathing rates returned to normal.

Resting allowed her body to recover and clear the lactic acid, reducing the pain in her legs.

Item 3: Human Genetics & Social Issues

(a) What were the potential risks to Susan as a teenage girl?

There was higher risk of complications during pregnancy and childbirth, such as high blood pressure and obstructed labor, due to her underdeveloped body.

She faced social isolation and shame from her family and friends.

The pregnancy could interrupt or end her education, limiting her future career prospects.

She would also face the financial burden of raising a child at a young age.

She was vulnerable to stress and depression due to the societal pressure and abandonment by her partner.

(b) Using the principles of genetics, explain how John was guilty or innocent.

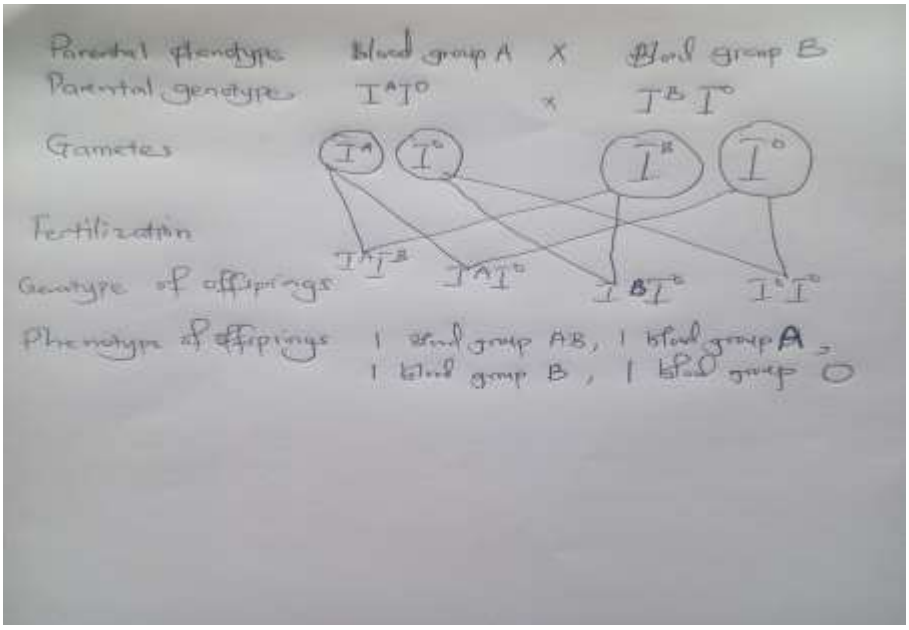
(i) Was guilty:

Susan's Genotype was blood group A, so her possible genotypes are I^AI^A or I^AI^O

John's Genotype was blood group B, so his possible genotypes are I^BI^B or I^BI^O

Child's Genotype: The child has blood group O, with a genotype of I^OI^O

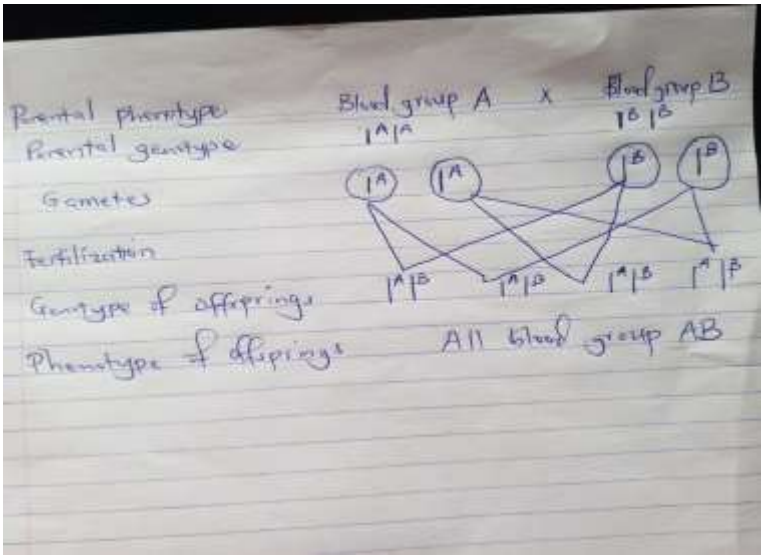
Explanation: For the child to have blood group O (I^OI^O) ,both parents must carry the recessive allele(I^O). This means Susan's genotype must be heterozygous I^AI^O, and John's genotype must also be heterozygous I^BI^O



Conclusion: If both Suzan and john are heterozygous for blood group O, they can produce a child with blood group O, making John guilty.

(ii) May have been innocent:

If both parents; Suzan and John are homozygous or one of the two, there will be no possibility of producing a child with blood group O since blood group A and B are dominant over O. This implies that a child has blood group O when he or she inherits two recessive alleles for O from both parents.



Therefore, in such a scenario where Suzan and John were homozygous for blood group A and B respectively, or one of the two was homozygous, there would be no possibility of the couple producing a child with blood group O and John may have been innocent

SECTION B: OPTIONAL ITEMS

Part I

Item 4: Environmental Conservation (Volcanic Eruption)

(a) Explain the environmental challenges observed and how they can be mitigated.

Soil Erosion caused by removal of the vegetation cover by volcanic eruptions leaving the soil exposed. This led to soil erosion as large volumes of water flowed down the slope during rain and washed the soil away.

The eruption destroyed the habitats of wild animals, forcing them to move closer to human settlements in search of food. This led to competition for food between humans and animals.

Herbalists lost their source of income because the eruption destroyed the plants they used for traditional medicine. This also led to people suffering from illnesses because their traditional remedies were no longer available.

Mitigations;

Planting trees is crucial to restore vegetation cover which will bind soil particles together hence reducing erosion.

Creating protected areas for wildlife to give the animals safe spaces away from human settlements.

Establish community plant nurseries to grow and restore the medicinal plant species that were lost.

(b) Explain why this environment should be restored.

Restoring the environment helps protect and restore the natural habitats of various plant and animal species, preserving biodiversity.

It helps restore the ecosystem's balance, ensuring essential services like pollination, nutrient cycling, and water filtration can resume naturally.

Restoration can provide new economic opportunities through eco-tourism, sustainable forestry, and the re-establishment of medicinal plant sources for herbalists.

Replanting vegetation helps prevent further soil erosion, improves water retention, and reduces the risk of flooding downstream which conserves the soil.

Restoring animal habitats in their natural environment reduces the likelihood of competition with humans over food and space.

Item 5: Environmental Conservation (Deforestation)

(a) Explain the cause of the challenges faced by the community.

The clearing of the natural forest destroyed the habitats of wild animals, forcing them to encroach on community crops in search of food.

The regular spraying of pesticides to control sugar cane pests resulted in chemical runoff into the nearby water body which causes water pollution.

The pesticides and other chemicals used flowed to water bodies in the area, leading to fish poisoning leading to reduced catch of fish.

(b) Suggest why the natural forest should be restored.

Restoring the forest provides a natural habitat for the displaced wild animals, reducing their encroachment on community farms and mitigating human-wildlife conflict.

The forest's vegetation acts as a natural buffer, filtering runoff from the land before it enters the water body. This helps prevent chemical pollution from the sugar cane plantation, which would protect the fish population and restore the fishermen's catch.

The forest is home to a wide variety of plants and animals, and restoring it helps preserve this biodiversity.

The forest is essential in climate regulation where by trees undergo transpiration to release water vapour in the atmosphere which contributes to rainfall formation.

Trees absorb harmful gases from the atmosphere and trap particles flowing along with water. This helps to clean air and water and maintains a healthy ecosystem.

Part II

Item 6: Lifestyle & Health

(a) Explain why Patrick could no longer do his routine activities with ease.

Heavy smoking likely led to a respiratory disease, such as bronchitis or emphysema, which damages the lungs. This reduces the surface area for gas exchange, so less oxygen is absorbed into the blood which affects production of energy.

Fatigue due to inadequate supply of oxygen to respiring cells which results into low rate of aerobic respiration and thus low energy production.

Smoking can also contribute to kidney disease. The kidneys are responsible for filtering waste products from the blood. Their poor function would lead to a buildup of toxins in the body, further contributing to his overall fatigue and ill health.

Swollen Legs, is a symptom of edema, which is often linked to poor kidney function. Damaged kidneys may not be able to remove excess fluid and salt, causing fluid to accumulate in the tissues, especially in the legs.

Malaria parasites affect red blood cells and thus reduce oxygen carrying capacity of blood which in turn affect the process of energy production hence leading to fatigue

Due to poor appetite, Patrick might have not eaten enough food to cater for energy production in the body

(c) Suggest how Patrick can manage his health status.

He should quit Smoking to prevent further damage to his lungs and other organs.

Patrick should Seek Medical Care and strictly follow the advice and medication prescribed by his doctor for his respiratory and kidney problems.

A healthy, balanced diet with low salt intake would help his kidneys function better and reduce the swelling in his legs.

Regular, moderate exercise as advised by a doctor would help improve his respiratory and circulatory health.

He should use mosquito nets and repellents to prevent mosquito bites or consider relocating to other areas other than the swampy area.

Item 7: Human Physiology & Adaptation

(a) Explain the cause of the challenges the athlete experienced initially and how he was able to win the marathon.

At high altitude, the air has a lower partial pressure of oxygen. This means each breath takes in less oxygen, leading to hypoxia (oxygen deficiency in the body's tissues).

The athlete's body initially couldn't get enough oxygen to fuel his muscles, causing him to experience shortness of breath, fatigue, and dizziness during training.

Over the month of training, the athlete's body adapted to the high-altitude environment in a process called acclimatization.

Physiological Adaptations:

His body increased the production of red blood cells. More red blood cells mean more haemoglobin, which increases the oxygen-carrying capacity of his blood.

His heart rate and breathing rate became more efficient at lower altitudes.

When he went to the competition, which was likely at a lower altitude, his body had an extremely high oxygen-carrying capacity due to the increased red blood cell count.

This "extra" oxygen allowed his muscles to perform aerobic respiration more efficiently, providing ample energy and preventing the buildup of lactic acid, which eliminated his fatigue and dizziness.

(b) Suggest how this athlete can maintain winning the marathon races.

He should continue to train at high altitudes for a few weeks before each competition to maintain his body's adaptation to respiration at low partial pressures of oxygen and increase red blood cell count.

Maintaining a diet rich in iron, which is essential for the production of haemoglobin and red blood cells.

Incorporating adequate rest and recovery periods into his training schedule to allow his body to repair and adapt.

Staying well-hydrated, as proper fluid balance is crucial for blood volume and oxygen transport.

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