PALUDA SECONDARY SCHOOL, BIOLOGY SEMINAR ANSWERS

ELEMENT OF CONSTRUCT 1

Item 1

Effects of human activities on the natural resources.

deforestation as a result of clearing of large areas of land leading to global warming hence increased temperatures. This leads to infertility of the area as its always dry.
loss of biodiversity due illegal poaching leading to reduced number of animal species.
illegal poaching leads to decline in wildlife population leading to extinction of animal species.
Poaching leads to loss of ecosystem balance as a result of disruption of the food chains and food webs.
Poaching leads to loss of tourism revenue as poached animals reduce the parks appeal to visitors hence loss of jobs to the local people.
Poaching leads to cultural heritage such as Uganda kobs when poached which erodes traditional values and norms.

What can be done to reduce the effects

- deforestation solved by afforestation/agroforestry/re-afforestation
- setting up anti-poaching units by training more anti-poaching teams to protect wildlife.
- Sensitization campaign on the community on importance to conserve the animals.
- Offering the community members employment in the ecotourism sector hence becoming active partners in conservation.

Benefits of persevering heritage sites like UNESCO

- beautiful scenery to attract tourists leading to income and also provide educational value to foreigners.
- Avoids extinction of animal and plants.
- Improved crop yield hence better harvest
- Preservation of the heritage provides cultural and historical value to the nation
- Job creation of those working there

Item 2

Challenges of the factory on the river

Water pollution by producing chemical wastes into the water that change the water PH killing the living organisms such as fish hence reducing fish numbers.

The factory releases hot water into the river after cooling the machines, this changes the temperature of the water killing aquatic organisms.

The river is enriched with chemicals such as nitrates and phosphates that favour algal blooms which when decompose use up the oxygen leading to death of fish species leading to reduced biodiversity.

Air pollution as the factory releases toxic fumes into the atmosphere such as Sulphur dioxide and nitrogen dioxide that dissolve in water causing acid rain that burn plant leaves reducing on the photosynthetic rate of leaves of a plant. This brings about reduced crop yield.

Heaping of soil at the river bank leads to erosion of soil into the river leading to chocking of the river with soil hence loss of habitat for fish.

Noise pollution by the factory due to running machines that disturbs the community's peace and causes migration of people to new areas.

Ways to minimize the effects of the challenges

- Treating of wastes before release into the water body to overcome pollution.
- Afforestation/reforestation/agroforestry to absorb gases such as Carbondioxide that bring about global warming and soil erosion.
- Construction of the factory away from the community to reduce on noise pollution.
- Fitting air filters in the chimneys of the vent pipes that take out the chemical wastes into the air to reduce on air pollution.
- Cooling the water before release into the waterbody.

Value of conserving rivers

- River banks have soils that are used for growing vegetables as they give ready water for irrigation.
- They are a source of clean water for animals to drink
- They contain sand that is a natural resource used for building bringing income.

Item 3

Environmental problems likely addressed by the town clerk and mayor

Dumping of raw sewage leads to disease such as typhoid, cholera that affect humans that use that water leading to poor health of the people.

Sewage contains nitrates and phosphates that enrich the water body favouring nitrates and phosphates that favour algal blooms which when decompose use up the oxygen leading to death of fish species leading to reduced biodiversity.

Burning plastics and polythene releases toxic fumes into the air that cause breathing difficulties to humans and their animals eventually leading to death.

Clearing swamps for agriculture leads to habitat loss for organisms.

When swamps are cleared, flooding of people's homes occurs causing migrations to occur.

Depletion of sand which is a natural resource for building

Many in cattle eat up vegetation and leave the land bear for agents of erosion to carry away top soil hence reduce yields.

How to solve the above effects?

- Recycle and reuse plastics to clean up the environment
- Treatment of sewage before release into the water body to reduce on water borne diseases
- Plant more trees/ agroforestry/Re-afforestation
- Sustainable use of swamps through reduced encroachment by sensitization.
- Paddock system of grazing to reduce on overcrowding of cattle.

c) ***why conserve swamps***

- source of raw materials such as papyrus reeds for the local factory there by supporting lively hoods.
- increases water purification before release into the main water body.
- swamps contain sand in them that is used for building
- mitigates floods as they absorb excess water and slowly release it into the surrounding water bodies.
- Erosion control by shrubs, grasses tress
- Reduction in greenhouse gases as they absorb carbondioxide hence a happy planet
- They offer scientists research and education on biodiversity and economic introduction.

Item 4

effects of environmental challenges

clearing swamps for settlement leads to loss of habitat for living organism such as fish leading to decreased yield for the fishing factory.

clearing swamps reduces water purification hence causing water borne diseases.

loss of raw materials for building industry such as papyrus

extinction of endangered species of plants leading to their reduced numbers as swamps are cleared.

no space to settle during water flow as it runs off leading to flooding on people's houses hence their displacement due to clearing of swamps.

deforestation as a result of clearing of large areas of land leading to global warming hence increased temperatures. This leads to infertility of the area as its always dry.

loss of biodiversity due illegal poaching leading to reduced number of animal species.

increased soil erosion that leads to loss of top soil for crop growth hence reduced crop yield as a result of deforestation.

Water pollution by producing chemical wastes from the factory water that changes the water PH killing the living organisms such as fish hence reducing fish numbers.

The various factories release hot water into the wetland after cooling the machines, this changes the temperature of the water killing aquatic organisms.

The wetland is enriched with chemicals such as nitrates and phosphates from the factories that favour algal blooms which when decompose use up the oxygen leading to death of fish species leading to reduced biodiversity.

Air pollution as the factories releases toxic fumes into the atmosphere such as Sulphur dioxide and nitrogen dioxide that dissolve in water causing acid rain that burn plant leaves reducing on the photosynthetic rate of leaves of a plant. This brings about reduced crop yield.

How to overcome the above environmental challenges

strengthening legal laws by limiting encroachment of wetlands

promote sustainable agricultural practices such as agroforestry in the wetland to benefit from food security.

rehabilitation of the damaged wetland by planting native vegetation, restoring water channels

promote public awareness education by involving community in decision making regarding wetlands.

Alternative livelihoods for the local communities such as ecotourism to learn more about conservation in other areas.

Importance of NEMA restoring the wetland to original state

- source of raw materials such as papyrus reeds from swamps for the local factory there by supporting lively hoods.
- increases water purification before release into the main water body.
- Support biodiversity and ecosystems
- mitigates floods as they absorb excess water and slowly release it into the surrounding water bodies.
- Erosion control by shrubs, grasses tress
- Reduction in greenhouse gases as they absorb Carbondioxide hence a happy planet.

ELEMENT OF CONSTRUCT 2

Item5

a.

- There was closed spacing, growing of the plants very close to each other which caused stiff competition for growth factors like nutrients, light, air required by the plant to grow and carryout photosynthesis.
- There was also a wrong pattern of planting; when the maize plants were planted earlier which led to rapid exhaustion of nutrients in the soil such as Nitrogen, ammonium ions required for proper growth of the plants.
- The garden being close to a dusty road caused the dust to accumulate on the leaves of the plants which reduced on the rate of absorption of light energy by the chlorophyl of the leaves which reduced on the rate of formation of starch by the plants.
- Late planting of the beans caused the beans to be shaded and covered by the already tall long maize plants which reduced the photosynthetic rate of beans of the beans thus stunted growth

b.

- Beans should be planted earlier in the garden or together with the maize since they are leguminous plants with root nodules with nitrogen fixing bacteria that fix nitrogen to form nitrate ions need by the plant for proper growth.
- Thinning out of some plants especially maize to create more space and light penetration to all plants for efficient photosynthesis to improve yields.
- Trees can be planted alongside the roads to trap some dust from the dusty road in the future and reduce on soil erosion.
- Irrigation to remove dust on leaves and moisture needed for proper germination of seeds.

Item 6

a**). i)**

Nancy's garden was next to a dusty road leading to accumulation of dust onto the leaves, covering the surface and stomata reducing the surface area for trapping sunlight and absorption of Carbondioxide respectively, hence reducing the rate of photosynthesis. **ii).** Bees, acted as pollinators and carried pollen grains from the anther heads to the stigma of bean flowers. When the pollen grains landed on mature stigma, they germinated and produced pollen tubes which grew via the micropyle to the embryo sac. Its generative nucleus divided by mitosis to form two male nuclei. One male nucleus fused with the egg

cell to form the seed embryo comprising the plumule and radicle. The second male nucleus fused with the polar nucleus to form the seed primary endosperm. The ovary wall formed the fruit wall and the integuments formed the seed coat.

b).

They developed root nodules where the nitrogen-fixing bacteria converted nitrogen to form nitrates, Nitrites used by the plants to grow.
Possessed broad leaves which trapped sunlight for photosynthesis.
They formed deeper roots to increase surface area for water absorption and anchorage.
Production of more root hairs to increase surface area for water absorption.

Item 7

a.

- Photosynthesis
- Gaseous exchange
- Transpiration
- Respiration

b. i.

There was accumulation of dust onto the leaves, covering the surface and stomata reducing the surface area for trapping sunlight and absorption of Carbondioxide respectively, hence reducing the rate of photosynthesis leading to poor yields.

b. (ii)

- Regularly spray cassava plants with water to remove dust.
- Use irrigation systems that minimize dust accumulation.
- Plant windbreaks or use row covers to reduce dust settling on crops.
- Mulch around plants to reduce dust stirring up from the soil.
- Consider planting dust-tolerant crop varieties.

Item 8

a). i).

- Photosynthesis
- Growth

ii).

- Spraying with fertilizers containing Nitrogen, phosphorus
- Soil testing to determine the pH and nutrients lacking and apply them accordingly
- Plant disease resistant crop varieties

- Practicing integrated Pest Management, by using a combination of techniques substrate biological control, crop rotation
- Mulching the garden
- Application of fertilizers

b).

During germination, a seed takes in water from the soil by imbibition through the micropyle. This makes the cotyledons swell and the Testa to split. The absorbed water activates enzymes, thus leads to breaking of food materials e.g. starch and protein which are stored in the cotyledons or endosperm. The soluble food materials are trapped to the growing points of the embryo where they are used to provide energy and making of new cells. The radical is the first to emerge, it grows down wards between soil particles, and root hairs develop a short distance from the root cap and start absorbing water and mineral salts. Absorption of water from the soil results into increase in the size of the seed and growth of the radicles and plumule which had the apical meristems, producing the first foliage leaves.

Item 9

a)

- Calcium
- Nitrogen
- Phosphorus

b.(i)

Calcium is used by plants for activation of enzymes and formation of new cells leading to rapid growth of roots and overall plant growth

Nitrogen is used to make Chlorophyll which traps sun light energy leading to increase in the rate of photosynthesis. Manufactured food from the leaves is translocated to other parts for growth and some of stored in seeds and fruits. Nitrogen is also used for formation of proteins (enzymes) leading to rapid growth.

Phosphorus promotes development of roots which absorb water and mineral salts from the soil which are transported to the leaves for use in Photosynthesis. It is also used in the formation of energy and Proteins used for growth by the plant.

b.(ii)

- Ground nuts have root nodules which harbor Nitrogen fixing bacteria which fix Nitrogen into nitrates used by the plants.
- Presence of meristematic tissues that divided by mitosis enabled Plants to grow taller to obtain sufficient light for photosynthesis.
- Closing of stomata during the day to avoid excessive water loss

- Producing chemicals which discourage herbivores and pests. • Possession of buds that developed into new leaves

ELEMENT OF CONSTRUCT 3 Item 10

- Town X had minimal air pollutants like Less dust, smoke, and toxic fumes than town Y. This allowed him to jog without respiratory issues, allowing his lungs to easily take in oxygen that was supplied to respiring tissues to release energy used for the contraction and relaxation of his muscles to bring about effective locomotion. His lungs were adapted to the cleaner environment, and he could exercise without complications.
- In town Y, the increased air pollution from industrial emissions (toxic fumes, smoke, and dust) is likely causing Mr. Zinart's respiratory issues. This is because, these gases contain carbon monoxide that combines permanently and irreversibly with haemoglobin to form carboxyhaemoglobin depriving his of enough oxygen to be supplied to respiring tissues causing weakness due to production of less energy reducing performance and activity.
- The toxic gases also caused constriction of bronchioles narrowing them reducing the amount of air going to the lungs causing difficult in breathing.
- These gases caused over secretion of mucus from the goblet cells lining the respiratory tract these block the respiratory tract making breathing harder, chest pain due to irritation and inflammation in lungs and air ways Coughing this is a body's' response to clear irritants from respiratory tract

Advice for Managing Challenges in Town Y

- Adjust jogging schedule. i.e., Avoid peak pollution hours (usually morning and evening rush).
- Choose cleaner routes
- Choose for areas with less industrial activity for jogging
- Wear protective gear such as masks rated for fine particulate matter
- Consult a doctor for medical check ups.
- Explore alternative exercises Consider indoor activities like gym workouts or yoga.
- Stay hydrated by Drinking plenty of water to help lungs function better.
- Relocate back to town X or any other town that has minimal pollution.

Item 11

a. (i)

- Mouth
- Brain • Pancreas

a. (ii)

- Johns' cousin can donate blood to John. This is because; he has antigens A and John lacks antibodies to recognise these antigens thus there will be no agglutination. In a addition, John's cousin is of legible age with ana appropriate legible weight to donate blood.
- John's Mother can donate blood to John. This is because; she is of blood group B with B antigens and John lacks antibodies to recognise these antigens thus there will be no agglutination. In addition, John's mother is of legible age and with an appropriate weight to donate blood.
- John's sister cannot donate blood to John; this is because she has an unappropriated weight which is not recommended to donate blood.
- John's brother cannot blood to John because his age and weight are also not recommended by medical people to donate blood.

b.

- Pancreas damage Affects insulin production, leading to blood sugar regulation issues and potentially impacting digestion.
- Teeth loss Affects chewing and digestion.
- Loss of consciousness: Indicates potential head trauma or brain injury.

Item 12

a.

• Kidney

• Liver

b)

- The Kidney filters waste materials from blood
- It regulates water levels in blood
- It regulates salt levels in blood

- The liver detoxifies harmful substances like alcohol to harmless substances
- Its stores blood
- Performs deamination

C)

- Much blood at a high pressure direct from the heart enters the glomerulus through the afferent vessel than that which leaves through efferent because the afferent vessel is wider than the efferent vessel. Blood leaves the glomerulus at even a higher pressure through the efferent vessel leading to ultrafiltration.

- Small molecules like glucose, amino acids, urea, water pass through the minute pores into the Bowmans capsule forming glomerular filtrate. Since her Kidneys are damaged, some of the proteins and red blood cells were able to pass through these minute pores into the glomerular filtrate and were present in her urine.
- The glomerular filtrate flew into the proximal convoluted tubule where useful substances like glucose, amino acids, salts and water are reabsorbed back into blood. The filtrate then flows into the Loop of Henle.
- In the descending loop of Henle, water was reabsorbed back into blood capillaries by osmosis.
- In the ascending loop of Henle, salts like sodium ions were reabsorbed back into blood by active transport. The filtrate then flew into the Distal convoluted tubule where salts and water were reabsorbed further. The filtrate continued to the collecting duct.
- In the collecting duct, water was further reabsorbed leading to a concentrated urine that was passed to the excretory organ through the urethra.

d.

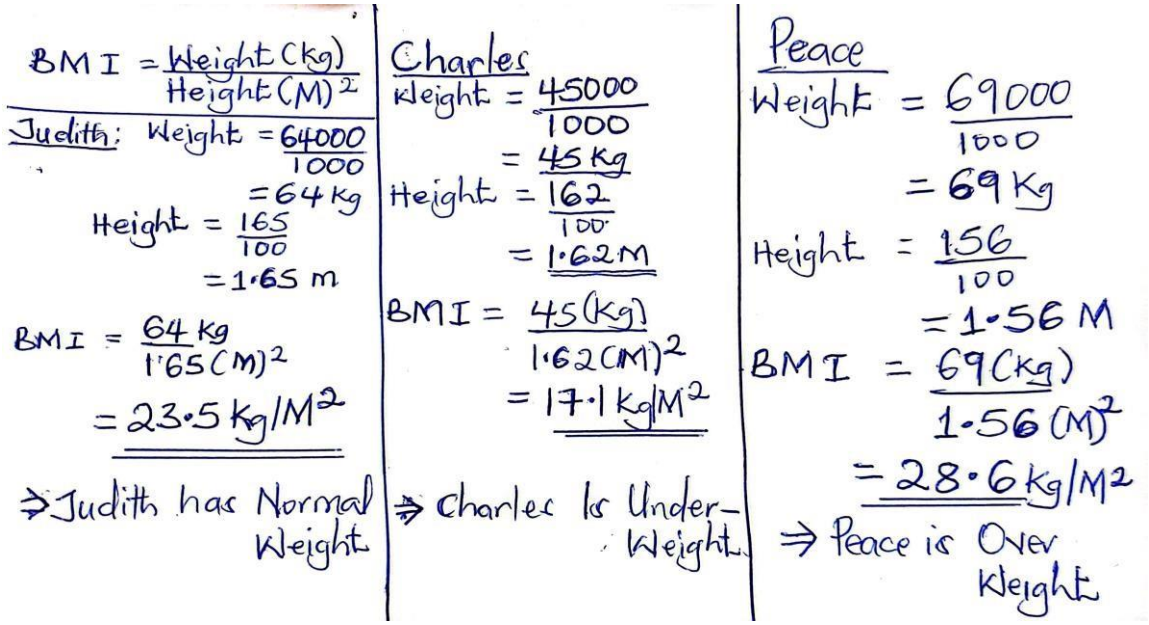
- Seek professional help for kidney and potential liver issues, including medications and lifestyle modifications.
- Kidney transplant
- Kidney dialysis
- Follow a kidney-friendly diet, limiting protein, salt, sugar, and phosphorus.
- Keep hydrated by drinking plenty of water.
- Reduce or eliminate alcohol consumption to protect liver and kidney health.

Item 13

a) i. It gives an idea about the correct weight for height if an individual (Underweight, Normal Weight, Overweight or Obese)
To know the Weight and height of an individual.

a

(ii)



b.(i)

- Poor growth in Children
- Frequent sickness due to poor immune system
- Hormonal imbalances such as low reproductive hormones leading to irregular menstrual cycles.
- Increased risks of miscarriages among pregnant women
- Weak bones
- Heart diseases such as heart failure, irregular heart beats **b. (ii).**
- High blood pressure due to narrow blood capillaries.
- Increased risk of diabetes
- Female infertility
- Osteoarthritis (pain in the bones due to worn out cartilage)
- Swollen painful joints
- Heart diseases

c.(i)

- Take a high calorie beverage along with a meal or snack
- Add extras e.g., scrambled eggs and fat free dried milk in soup and stews
- Eat more frequently e.g., have 5 to 6 smaller meals a day rather than 2 or 3 larger meals
- Eat meals with fibrous carbohydrates e.g., brown rice and beans and healthy foods e.g., mono-saturated or poly saturated fats in foods e.g., nuts, avocados, oils and fish

- Choose nutrient rich food e.g. whole grains, bread, cereals, fruits, vegetables, diary products, lean protein sources, nutsy and seeds **c.(ii)**
- Engage in weight management programs
- Carry out regular physical activity
- Carry out intermittent fasting
- Follow a healthy eating plan with fewer calories
- Feed on calories restricted diets such as 120 to 150 calories per day for women and 1500 to 1800 calories for men
- Take weight loss medicines as prescribed by your doctor.
- Undergo bariatric surgery for extreme obese individuals by making changes to individual's digestive systems

Item 14

Category	**Nutrient**	**Use**
Pregnant women	More proteins More vitamins More minerals, moderate carbohydrates and Moderate healthy fats and oils	Proper growth, Cell repair, Energy production during starvation, Healing of damaged cell Healthy body/Strong immunity, Blood clotting, Strong bones, Energy production, Energy production Foetal brain development
Crawling babies	More proteins, More vitamins More minerals, moderate carbohydrates and healthy fats and oils	Proper growth, Cell repair, Energy production during starvation, Healing of damaged cells Healthy body/Strong immunity, Blood clotting, Strong bones, Energy production, Energy production
Footballers and Athletes	Carbohydrates, vitamins minerals Proteins	Energy production Healthy body/Strong immunity, Blood clotting, Strong bones, Energy production,

		Proper growth, Cell repair, Energy production during starvation, Healing of damaged cells
Office workers	Moderate proteins Moderate minerals vitamins Less carbohydrates	Proper growth, Cell repair, Healing of damaged cells Strong bones Healthy body Energy production
Old people	Moderate proteins, more vitamins and minerals, little carbohydrates no fats	Cell repair, Healing of damaged cells Strong immunity, Blood clotting Strong bones Energy production

ELEMENT OF CONSTRUCT 4

Item 15

a. (i)

- Addiction to alcohol
- Death
- Damage of body organs like the liver
- Imprisonment due to crime or violence

a (ii.)

- Alcohol is a Central Nervous System Depressant that reduces the transmission of pain signals. This is because of the chemicals in alcohol that block the release of neurotransmitters that facilitate movement of an impulse across a synapse to the spinal cord.
- Alcohol activates and stimulates the release of painkillers like endorphins that bind to pain receptors in the brain and spinal cord to reduce pain. b.
- Seek guidance and counselling in the dangers of alcohol consumption
- Avoid friends/peers that influence him into alcohol consumption

- Engage in productive work like Focusing more on academics to keep him busy.
- Quit Alcohol consumption and go for rehabilitation to recover from addiction.

Item 16

a. (i)

- He appears weak due to low aerobic respiration, less energy is produced due to reduced oxygen carrying capacity of blood caused by increased carboxyhaemoglobin levels in blood.
- He is older than his age because more cells die compared to those that are replaced due to reduced energy production needed for cell division
- Liver damage due to alcohol consumption that may increase insulin resistance by the liver cells leading to diabetes,. Lung cancer due to smoking that can lead to death.
- Deposition of fats into the blood vessels after metabolism of the alcohol and constriction of the blood vessels due to presence of nicotine leads to hypertension.
- Imprisonment due to violence and chaos caused by taking marijuana and cocaine

a. (ii)

- School dropout by his children due to failure for their school fees to be paid.
- Divorce and broken family due to the beatings the wife experiences.
- Family Neglect he is so much attached to his friends than his family
- Domestic violence since he beats his wife.
- Malnourishment due to poverty.

b.

- Seek guidance and counselling in the dangers of alcohol consumption
- Avoid friends/peers that influence him into alcohol consumption
- Engage in productive work like Focusing on money making to keep him busy.
- Quit Alcohol consumption and go for rehabilitation to recover from

addiction.

Item 17

a. sound waves are trapped by the pinna conducted by the auditory canal to the ear drum which vibrates and transmits vibrations to the ear ossicles which amplify the vibrations. The oval windows vibrate, pressure waves were created in the fluid within the inner ear, sensory cells of the organ of Corti are stimulated, impulses are generated and transmitted via the auditory nerve to brain for interpretation. Impulses from the brain are transmitted along the motor neurone to the adrenal glands stimulating it to secrete adrenaline hormone which increases the metabolic rate providing energy needed for running. Increased heart beat rate and breathing rate for faster supply of oxygen to respiring muscles to enable energy production.

b. **(i)**. Diabetes mellitus; due to inability to secrete insulin as a result of a malfunctioning pancreas. Reduced responsiveness of the target cells to insulin hormone due to presence of fats around the liver cells

b (ii).

- Taking regular insulin shots or injections to provide insulin which regulates the sugar levels.
- Guidance and counselling from health practitioners on how to handle the situation
- Regular exercises in order to reduce the fay around liver cells.

Item 18

a. **(i)**.

Pain receptors or thermos receptors detected the heat, generated impulses which are transmitted along the sensory neurone to the spinal cord via the dorsal root. The spinal cord integrates sensory information.

a (ii).

- Alcohol contains toxins or substances that impair/affect/slow down the nerves/impulse transmission preventing per from sensing heat.
- Alcohol affects the cerebellum hence interfering with body balance and coordination.
- Alcohol is converted into fat which blocks blood vessels leading to hypertension.
- Damages the liver cells leading to liver cirrhosis

b. <u>(i).</u>

- Thermoreceptors/ pain receptors detect the stimulus, generate impulses which are transmitted along the sensory neurone to the spinal cod via the dorsal root.
- Impulses are transmitted from the sensory neurone to the relay neurone via a synapse, from the relay neurone to the motor neurone via a second synapse.
- Impulses are then transmitted along the motor neurone to the effectors via the ventral root to the effectors.
- The effectors i.e., biceps contract and triceps relax pulling the radius up towards the shoulder bending the arms causing it to withdraw from the hot object.

<u>b (ii).</u>

- Seek guidance and counselling in the dangers of alcohol consumption
- Avoid friends/peers that influence him into alcohol consumption

<u>Item 19</u>

a. Light rays from the dog are converged and an image is formed onto the retina. Photoreceptors are stimulated to generate impulses which are transmitted along the optic nerve to the brain for interpretation.

Impulses from the brain are transmitted along the motor neurone to the adrenal glands stimulating them to secrete adrenaline hormone

Adrenaline hormone increases the heart beat rate and breathing rate, metabolic rate increases providing energy for the Flexion and Extension so as to beat the dog. During the flexion, the biceps contracted and the triceps relaxed, pulling the radius and forearm

upwards towards the shoulder thus bending the arm, and during the extension, the Triceps contracted and the triceps relaxed pushing the ulna away from the shoulders hence straightening the arm causing the beating of the dog.

b. (i)

- Family neglect due to bad behaviours
- Early/teenage pregnancy since she is most likely/exposed to rape from wrong doers
- Dropping out of school due to suspension or expulsions as a result of such behaviours

b (ii)

- Guidance and counselling on dangers of moving late at night
- Avoid bad influence from friends who are luring her into watching films at night/ withdraw from bad peer groups.
- Quit watching movies at night to avoid the dangers.

ELEMENT OF CONSTRUCT 5 *Item 20*

a.

Let I^A be the allele for blood group A

Let I^B be the allele for blood group B

Let I^O be the allele for blood group O

Parents Male **X** Female

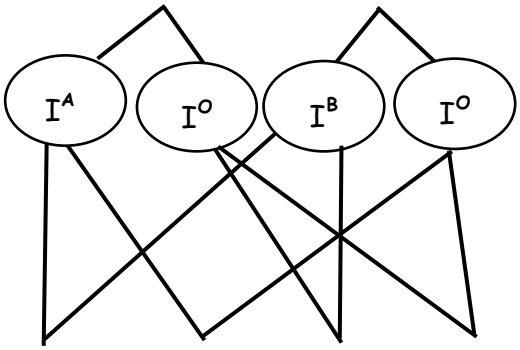
Parental phenotype Blood group A **X** Blood group B

Parental genotype I^AI^o **X** I^BI^O

Meiosis

Gametes

Random fertilisation



F1 Generation I^AI^B I^AI^O I^BI^o I^oI^o

F1 phenotype 1 blood group AB: 1 blood group A: 1 blood group B: 1 blood group O

Its possible for Mr Kasozi to be the biological father to the child. b.

- Excessive bleeding leading to anaemia.
- Death due to excessive loss of blood if injured
- Joint pains and joint damage
- Inflammation and swelling in the ankles.

c. A successful blood transfusion can be done using safe blood. Neither parents has safe blood to transfuse with the child. This is because both parents have antigens with in their blood that are going to be recognised by the antibodies present in their child's blood. Safe blood can be obtained from an individual who has the same blood group like that of the child to avoid agglutination and haemolysis.

S ***Item 21***

a. (i)

The son suffered from sickle cell disease that affects haemoglobin production causing red blood cells to become sickle shaped at low oxygen concentrations and break down prematurely. It is a genetic disease caused by a recessive allele thus their son was homozygous recessive for the sickle cell trait. **a (ii)**

Let the allele for normal haemoglobin be Hb^A

Let the allele for abnormal haemoglobin be Hb^S

Parents Male **X** Female

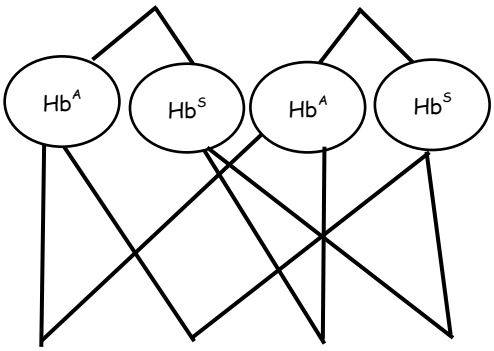
Parental phenotype normal **X** normal

Parental genotype $Hb^A\ Hb^S$ **X** $Hb^A\ Hb^S$

Meiosis

Gametes

Random



fertilisation

F1 Generation Hb^AHb^A Hb^AHb^S Hb^AHb^S Hb^SHb^S

F1 Genotype $1Hb^A\ Hb^A$: $2\ Hb^A\ Hb^S$: $1\ Hb^S\ Hb^S$

F1 phenotype 3 normal: 1 Sickler

b. (i)

This is only because the woman must have been rhesus negative and the man rhesus positive, the foetus formed was rhesus positive sensitizing the mother's body to produce antibodies against the rhesus positive antigens. the first baby survived because the antibodies of the rhesus positive antigen were few but with subsequent pregnancies, the antibodies were many and had accumulated, were passed onto the baby via the placenta destroying the babies red blood cells causing the baby's death

b

(ii)

- Encourage Musa and his wife to prioritize regular prenatal visits to healthcare providers for monitoring her health and the baby's development, obtaining necessary screenings, and addressing any potential issues early on to ensure a healthy pregnancy and delivery.
- Seek genetic counselling to understand the risk of passing genetic conditions, like sickle cell anaemia, to their children.
- Emphasize the importance of a balanced and nutritious diet for Musa wife during pregnancy to support the baby's growth and development and reduce the risk of complications.

- Proper ventilation, cleanliness for their future children so as to minimise complications that arise because of low oxygen levels to the children.

Item 22

a. (i)

Let the allele for normal Blood clotting be H
Let the allele for Haemophilia be h

Parents Male **X** Female

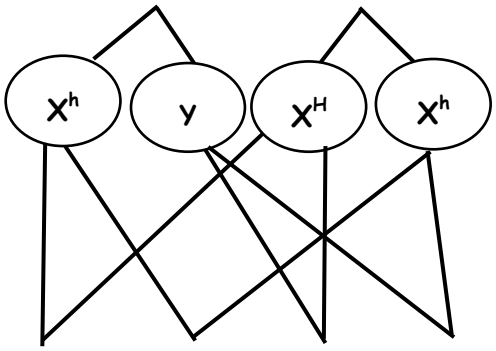
Parental phenotype normal **X** normal

Parental genotype X^hY **X** X^HX^h

Meiosis

Gametes

Random fertilisation



F1 Generation X^HX^h X^hX^h X^HY X^hY

F1 phenotype: 1 normal female: 1 haemophilic female: 1 normal male: 1 haemophilic male

The baby's biological father can be determined by testing and see who is haemophilic among the alleged fathers, because he must have contributed an X chromosome having the defective allele to the child.

a (ii)

When one of the boys inserted an erect penis inside Isabellas Vagina, at orgasm, the penis released large number of sperms near the cervix. The cervix relaxed and opened up as sperms swum through its opening to the uterus then to the oviduct where fertilization takes place. When a sperm got into contact with the egg membrane, it released enzymes from acrosome which broke the egg membrane and enabled the sperm

cell penetrate into the cytoplasm of the ovum. When the sperm cell enters, the egg membrane becomes thickened to form the fertilization membrane which serves as a barrier preventing the entry of other sperm cells. The nuclear membrane of the two gametes breaks down and male nucleus fuse with a female nucleus to form a fertilized egg that later divided by mitosis into a blastocyte that implanted in the endometrium causing pregnancy.

Item 23. Refer to blood groups and Haemophilia

Item 24

a. (i)

Millys child is suffering from a genetic disorder called Downs syndrome that comes as a result of non disjunction of the chromosomes of the 21st pair.

Parents Male **X** Female

Parental phenotype normal **X** normal

Parental genotype **46 X 46**

Meiosis

Gametes **23** **23** **22** **24**

Random fertilisation

F1 Generation 45 47 45 47

a (ii)

- Defilement since she was 15 years of age

- Teenage Pregnancy since she was a teenager
- School dropout because she had to give birth and also look after her child • STI contraction like Hepatitis B
- Rejection by Peter.
- Poverty since she has no job to earn from.

b. (i)

- Breast feed the baby for at least 6 full months
- Take the baby for immunisation
- Feed the child on a balanced diet
- Have regular Medical Check-ups.
- Have personal therapies for the child to improve speech of the child.

b (ii)

- Abstain from sex until marriage
- Use protection like condoms to prevent early pregnancies and STIs
- Report Such men who approach them to parents or appropriate offices.

SOLUTIONS TO PRACTICAL ITEMS

Solutions to practical items

Item 1

Aim: A scientific investigation to find out the nutrient composition of solution P, Q, R, S so as to know which ones to be added to the baby's diet for good health.

Hypothesis: Solutions P, Q, R and S contain proteins and vitamin C

Variables;

independent variable*: Solutions P, Q,R, S and Reagents used*

dependent variable*: colour changes-****controlled variable****: volume of solutions P, Q, R, S. volume of reagents used, clean test tubes.*

Results/ observation

Test	Solution	Observation	Conclusion
Protein test	**P**	Turbid solution turned to blue solution	Proteins absent
	Q	Turbid solution turned to blue solution	Proteins present
	R	Turbid solution turned to purple solution. Acc: violet solution	Proteins present

	S	Colourless solution turned to blue solution	Proteins absent
Vitamin test	**P**	Blue solution turned remained as a blue solution.	Vitamin C absent
	Q	Blue solution turned to colourless solution	Vitamin C present
			Vitamin C absent
	R	Blue solution remained as a blue solution	
	S	Blue solution remained as a blue solution	Vitamin C absent

Procedure Materials

Test tubes, dropper, test tube rack, dilute sodium hydroxide solution, copper (ii) sulphate solution, DCPIP solution.

Protein test

To 1cm^3 of solution P, Q, R and S in separate test tubes was added 1cm^3 of dilute sodium hydroxide solution followed by 3 drops of scopper (ii)solution and the solution shaken

Vitamin C test

To 1cm^3 of DCPIP solution in a test tube, was added food solution P, Q, R and S separately drop by drop till in excess.

Analysis and recommendation

Solution R contains proteins while solution Q contains vitamin C.

The proteins build the body tissues reducing the effect of pot belly in children. The vitamin C boosts immunity of the baby reducing frequent sickness and bleeding gums in the baby.

Item 2

***Aim**; A scientific investigation to determine the effect of solution **Q** and **R** on plant organ **M** so as to explain the difference in the quality of chips made by Susan in order to save her business.*

Hypothesis: concentration of solutions Q and R have different effects on specimen **M**

Variables:

Independent: concentration of the solution Q and R

Dependent; texture and final length of the cylinders.

Controlled; initial length of cylinders, initial volume of solutions Q and R, time taken for cylinders to settle in solution.

Materials

Cork borer, test tubes knife, labels, stop clock, measuring cylinder

Procedure

Using a cork borer, two cylinders were obtained from specimen M

The cylinders were then trimmed to a uniform length of 3cm long.

Two test tubes were the labelled as Q and R

10cm^3 of each solution poured into each test-tube then one cylinder was dropped into the solutions.

The set up left to stand for 20minites.

After this time, the cylinders were the removed and placed on a white paper then their final length measured and the cylinders felt between fingers. The results were the recorded in the table below. **Results**

solution	Initial length/cm	Final length/cm	Change in length/cm	Texture of cylinder
Q	3.0	3.1	+0.1	Hard, rough
R	3.0	2.9	-0.1	Soft, smooth

Recommendation and analysis

From the results above the cylinder that was placed in solution **Q** increased in length, became hard and rough because it was placed in a hypotonic solution to the cell sap hence water moved by osmosis from the solution to the cylinder causing it to swell and become turgid making the chips appear bigger in size for sell.

When the chips were soaked in solution **R** they decreased in length, became smooth and soft because the cylinder was placed in a hypertonic solution to the cell sap hence lost water by osmosis to solution **R** making the cells to shrink and become flaccid. This explains why the chips appear small in size. SHence, I recommend that Susans should always use water from source **Q** to soak her sliced Irish potatoes.

Item 3 Aim

*Scientific investigation to determine the ability of the soil samples **A** and **B** to retain water so as to explain to the farmer which one of the plots would give the him better yields.*

Hypothesis

Soil sample B retains more water than soil sample A

Acc; soil samples A and B have different abilities to retain water

Variables

Independent; soil samples A and B, nature/ size of soil particles.

Dependent; volume of water retained and collected; time taken for the first drop to appear.

Controlled; volume of soil used, volume of water added, time taken for the experiment, size of funnel, amount of cotton wool.

Procedure

Two beakers were labelled as A and B

A small piece of cotton wool was obtained and placed on the neck of each measuring cylinder.

30 cm^3 of each soil sample was measured differently and poured onto each funnel.

30cm^3 of water was added to each of the soil sample

The experiment was then left to stand for 20minutes

After this time, the volume of water collected and retained was the recorded in the table below

Results

Soil sample	***A***	**B**
Volume of water added/cm^3	30.0	30.0
Volume of water collected/cm^3	12	7
Volume of water retained/cm^3	18	23

Analysis and recommendation

From the results above, soil sample **A** retains less water hence many plants with short roots absorbed less water needed for photosynthesis as most of it is washed away to the bottom or valley with the nutrients leading to reduced yield.

Soil sample **B** retains more water hence plants with many short roots can easily absorb it for photosynthesis as the many few roots increase the surface area for water absorption hence increased yield.

I therefore recommend the farmer to use plot **B** to grow rice for better yield.

Item 4

a)

Kingdom: Animalia

Reasons: have limbs for locomotion

Phylum: Arthropoda

Reasons: have segmented bodies, jointed legs, exoskeleton

b)

specimen P has a large abdomen to store blood

has a sharp pointed mouth part/ chelicera to pierce the skin of the animal for entry.

dull colour to camouflage on the body of the animal's avoiding predation

flattened body to fit onto the cow's skin

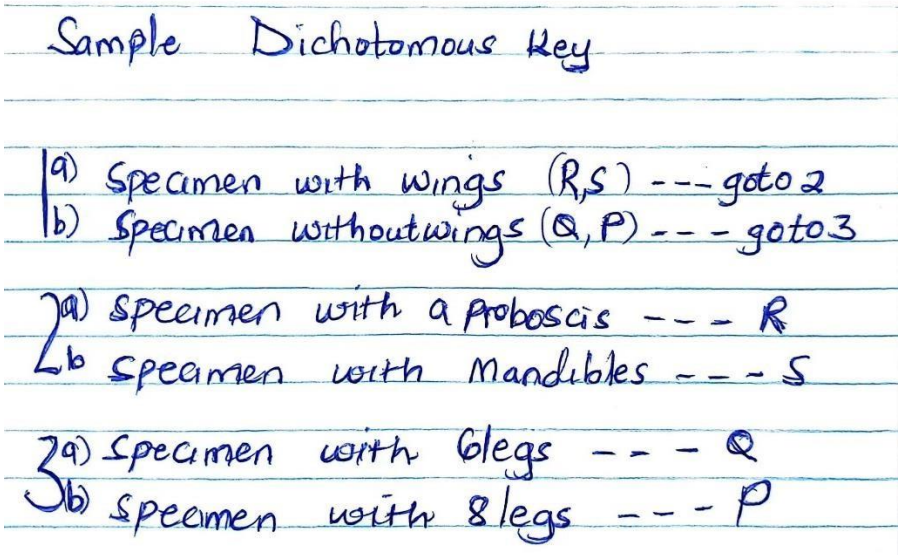
have claws on the legs to firmly grip on the body of the cattle.

Have hard exoskeleton to protect it from the water loss during heat periods.

Many legs for locomotion

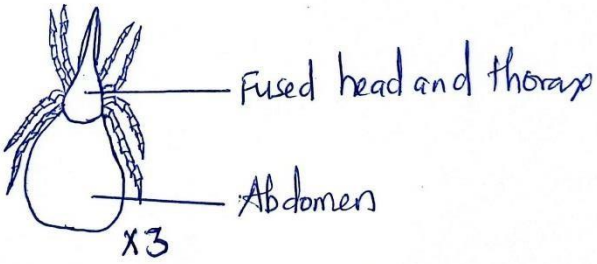
Jointed legs for flexibility during locomotion.

c) **Dichotomous key**



d) Drawing of specimen specimen P

Drawing of specimen P showing the main body parts



Item 5 a)

L is insect pollinated flower

Observable features

has brightly colored petals

scented

has nectar guides

Sticky pollen grains

K is a wind pollinated flower

Observable features

No scent

Produces many dusty pollen grains Has long hanging anthers on the outside

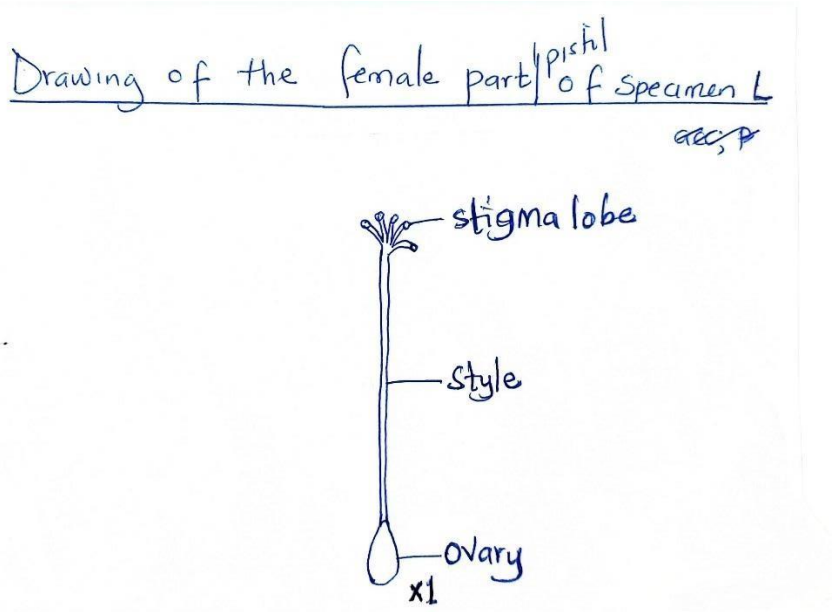
b) Specimen L has brightly colored petals to attract pollinators that carry out pollination.

L has produces scent that attracted pollinators.

L has nectar guides on the specimen to lead the pollinators on to the nectar glands.

L produces sticky pollen grains that attach on the body of the pollinator hence carrying it from the anthers to the stigma.

c) *Drawing of the pistil / female part of specimen L*



~END~