ST. CLISK SCIENCE DEPARTMENT TERM ONE

S.6 HOLIDAY PACKAGE 2026

BIOLOGY ITEM

Over the last decade, fishermen in **Kalangala District** observed a decline in the population size and body weight of *Lates niloticus* (Nile perch). Researchers from Makerere University investigated tissues from fish collected at three landing sites and found the following;

Parameter	**Site A (near fish-processing factory)**	**Site B (rural landing)**	**Site C (protected zone)**
Mean muscle ATP ($\mu mol/g$)	3.2	5.1	6.0
Mitochondrial inner membrane (%)	48%	22%	8%
DNA mutations in gene controlling growth hormone receptor	35%	14%	6%
Frequency of juveniles surviving to adulthood	12%	33%	41%

Water samples from site A showed high levels of microplastics and heavy metals. Genetic analysis revealed **point mutations**, **insertions** and **deletions** in mitochondrial DNA, along with altered codons in the nuclear genes related to growth and metabolism. Fishermen noted a visible increase in smaller-bodied fish over the years.

Task:

(a) Explain how microplastics and heavy metals could cause the mitochondrial inner membrane damage observed at site A. (05 scores)

(b) Using the data in the table, discuss the relationship between mitochondrial damage, ATP levels and fish growth. (06 scores)

(c) Assess how mutations in the growth hormone receptor gene could arise from errors in DNA replication and how they can affect protein synthesis. (06 scores)

(d) The increasing proportion of smaller-bodied fish is suspected to be an example of evolutionary change. With reference to the principles of natural selection, explain how this trend can occur. (05 scores.)

Propose two (2) practical interventions that conservation agencies could implement to restore the Nile perch population.

CHEMISTRY ITEM

Gluconate supplements are widely used to provide essential mineral ions needed by the body, especially in the prevention and treatment of mineral deficiency and related health problems. For such supplements to be safe and effective, the raw materials used in their manufacture must be of the correct chemical composition and free from unsuitable impurities. A pharmaceutical company received a batch of raw materials for production of gluconate supplements from a supplier.

During routine inspection, the sample labelled solid X was found to be partially soluble in water. This suggested that the material was not a single pure substance but a mixture. A preliminary investigation further showed that solid X contained two cations and two anions, indicating that the sample consisted of more than one salt. Before the batch could be approved for use in manufacturing gluconate supplements needed by patients in the community, the company had to identify the ions present in solid X and determine whether the material was suitable for the intended purpose.

However, the laboratory technicians were unable to complete the qualitative analysis and could not advise management. The sample was therefore taken to your school laboratory for qualitative inorganic analysis.

You are provided with solid X, which is a sample of the raw material. *(Hint: Solid X is a mixture of Zinc carbonate and Aluminum sulphate)*.

Task

Design and carry out an experiment to identify the cations and anions present in solid X, and use your findings to advise the company on whether the batch is suitable for the production of gluconate supplements.

(your Design must be including preliminary, specific and confirmatory tests, observation and deductions, conclusion and advise)

PHYSICS ITEM

A 14-seater minibus (Taxi) has stalled on a flat, level road in Nakawa trading centre. The conductor and three passengers attempt to push it to the side of the road. Together, they exert a combined, constant force of 800N in the direction of the road. They successfully

push the minibus a distance of 25 meters over a period of one minute. The local mechanic, who is also a physics enthusiast, uses this situation to explain the concept of work to his apprentice.

Task;

As a learner of physics

a) Define the term work and state its SI unit
b) Calculate the total work done by the conductor and passengers in pushing the minibus
c) If one passenger pushed at an angle of 30oC to the horizontal with a force of 200N, calculate the work done by this specific passenger over the 25 meter distance
d) Explain why a traffic officer who directs traffic but does not push the bus does no work on it.
e) If the same amount of work was used to lift the minibus vertically upwards, calculate the height it would be raised. (Mass of minibus = 1500kg)

MATHS ITEM

A Civil Engineer, Marcus, is planning the excavation for a 1-meter section of a specialized trench. The base of the trench has an unusual, curved cross-section designed to maximize drainage stability. The vertical distance, or depth (y), of the trench's cross-section (in meters) at a horizontal distance x (in meters) from the trench wall is modelled by the function $f(x) = x/\ (x2-3)$ Marcus needs to calculate the total cross-sectional area of the trench between $x = 2\ m$ and $x = 3m$ to accurately estimate the volume of soil to be removed. Since a quick estimate is needed on-site, Marcus uses an approximate method with five strips to approximate this area.

After the excavation the engineer was called by his bosses for a certain job along Kampala-Masaka Road. He boarded a taxi in the event that he had no transport means The taxi stages a long Kampala-Masaka Road are 10km apart. an express taxi travelling between two towns stops at these stages except in case of an emergency when it is permitted to stop at a point between two stages the fares up to first, second, third and fourth stages from Kampala are shs2000, shs3500, shs5100 and shs7500 respectively. Marcus paid to travel from Kampala up to the fourth stage but fell sick and had to be left at a health centre 33km away from Kampala. given that he was refunded money for part of the journey he had not travelled,

Task

As a mathematician, Help

a) Marcus to determine the percentage error made in his approximated area and make justifications

b) The conductor to determine the approximate amount Marcus is to receive. Another person had only shs6250 was allowed to board a taxi but to be left at a point worth his journey. How far from Kampala was he to be left.

AGRICULTURE ITEM

a) Jane is a farmer who keeps a few cattle under zero grazing. She feeds her animals entirely on forage. The mother cow was diagnosed with a pair of in calf growing embryos, she thought of giving an extra feeds to the in calf with right and sufficient nutrients to cater for high nutrient demand. She has been advised to mix the feeds home since the already mixed feeds seem to be expensive. She therefore wants to come out with her own mixed feeds using the ingredients of 32% crude protein, wheat bran containing 24% crude protein and rice bran of 18% crude protein, soya bean meal of 45% crude protein and blood meal of 30 crude proteins. the basal feeds to be mixed in a ratio of 2:1 and the protein feeds 1:2 respectively she also wants to add a salt of 3% to mix a total ration of 1000 kgs

Task;

As an agriculture extension worker try to give guidance to Jane on how to mix the required ration.

b) Many farmers who have tried the same formula like Jane have not realized 100% positive results because they feed their mixed rations to mature and young animals, they feed local and exotic animals together, they feed unprocessed feedstuff, feed animals regardless of health stuff, feeding animals too much, feeds with no additives and anti-metabolites

Task;

As an agriculture extension worker continue advising Jane and other farmers on what to do improve on the digestibility of homemade rations.